

EPSRC Frontier Engineering Award 2013



**Modelling Complex and Partially Identified Engineering
Problems – Application to the Individualised Multi-scale
Simulation of the Musculoskeletal System**

Modelathon 2020 Report for OATech+

Version Log			
Issue Date	Version	Author	Change
08-Jan-20	0v1	Norman Powell	First Draft of Proposal
24-Mar-20	0v2	Norman Powell	Expand Structure, add Agenda
25-Mar-20	0v3	Norman Powell	Add Feedback, Web Article and Conclusion
25-Mar-20	1v0	Norman Powell	Submission Version

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Introduction

The Modelathon is training event for early stage and early career researchers in Computation Medicine and related fields. It is based on the concept of a hackathon where computer programmers address problems in a short timeframe, by writing computer code. The Modelathon uses computational models and simulations to address authentic research questions. Three to five teams of 5-7 researchers work a series of related challenges to develop a multiscale computation simulation to address a clinical or clinical research based question.

This is the fifth iteration of the Modelathon and this year's theme is the *Optimisation of interventions for osteoarthritic patients with multi-scale modelling*.

The event is held over four days:

- Day 1 is a symposium, *Experimental and computational approaches to optimise the treatment of osteoarthritis*, which introduces the research field that the challenges are based, delivered by representatives from MultiSim, the OATech+ network and a clinical researcher in the field. The day one symposium is open to researchers, who are interested in learning about the field, but who are not necessarily competing in the Modelathon.
- Day 2 a series three of related challenges are issued that focus the teams on developing models at scales, specifically: full body modelling; finite element model of the knee-joint; and a tissue model of the effects of osteoarthritis over time.
- Day 3 a series of further challenges are provide that require the integration of the Day 2 models into a multiscale simulation to describe the effects of the progression of the disease and the medical interventions.
- Day4 the teams present their findings and the winning team is awarded a prize.

This year the Modelathon was be held on Monday, 13th January to Thursday, 16th January in The Diamond, University of Sheffield. The majority of costs will be incurred supporting and hosting this event and building and testing the challenges and infrastructure, which is this year a cluster of Google Cloud Virtual Machines: 5 GPU machines, one for each team and 31 CPU machines, one for each participant.

This report provides the Costing of the event, the Agendas as delivered, the feedback from the event, with participation numbers and data from previous versions, a draft web article for OATech+ to approve and a conclusion.

Costs and Funding

Project Funded

This event is initiated, organised and funded by the hosting research projects. The costs of researcher, academic and administrator time in developing and organising the event is provided by the hosting project and not explicitly costed. The project also provides funds to cover any substantive costs, not covered by in-kind support. In previous years MultiSim has covered these costs. This year OATech+ has agreed to provide £11,000 to cover these costs. MultiSim2 has also agreed to contribute up to £4,000 to cover any unmet costs.

Cloud Compute Costs

The costs for the cloud computing will be covered by an award of \$5000 (~ £3,825) in research credits from the Google's Cloud Platform team. It is anticipated that this will more than cover the costs associated with testing and running the event on the cloud.

Cloud Infrastructure Support

In previous years, this has been provided by a member of staff co-funded by Insigneo through the MultiSim project and CiCS.

This year this support was not available and support was contracted from OCF, again co-funded by CiCS. The total cost of the contract is £18,000, £9,000 of which is covered by CiCS, the remaining £9,000 is a cost to the event. This will be covered by £8,000 of OATech's contribution and £1,000 from the Industrial Sponsorship.

Software Licences, Support and Sponsorship

The software companies: *Ansys*, *Dassault Systemes*, *Materialise* and *Synopsys*, whose software is used in processing data and running the simulations during the Modelathon generously provide software licences for testing before and use during the event, technical support during testing and in person at the event and further sponsor the event at £250 each. This provides £1,000 to subsidise the hosting costs of the event.

Venue and Accommodation

The Diamond is provided at no cost by the University of Sheffield, since this is principally a training event supported by research projects.

Participants requiring accommodation pay a registration fee that covers their accommodation and contributes a small amount to the catering. This year there a non-residential fee was included to encourage attendance for those who registered. Accommodation is covered by the participants fees.

Catering

Refreshments and meals for the participants over the duration of the event, estimated at £4,000 is a substantive cost to event. OATech's contribution of £3,000 will go toward covering this cost, with the excess £1,000 covered by MultiSim2.

Other Costs

Travel for 3 national speakers at the symposium: £300 (3 x £100).

Amazon Gift Vouchers for winning team: £700 (7 x £100)

Taxis to transport residential participants and their luggage between The Edge and The Diamond on the first and last days: £200

These costs will be covered by MultiSim2's contribution.

Agenda

Day 1 Symposium

Event Programme: AGENDA Day 1		
Monday, 13 January 2020, The Diamond, 32 Leavygreave Road, Sheffield S3 7RD		
10:00	Registration and Refreshments	
10:30	Welcome	Dr Enrico Dall'Ara Modelathon Lead
10:35	Challenges in personalised musculoskeletal modelling: an insight from the MultiSim project	Prof Claudia Mazzà, Director of MULTISIM
11:05	A brief overview of the OATech+ Network and research updates about: Linking Biomechanics, Biology and Clinical measures to understand the effects of knee OA and responses to surgery.	Professor Cathy Holt, PI of OATech+ network
11:35	Meeting safety requirements of personalised treatment using <i>in silico</i> trials	Prof Richie Gill, President of British Orthopaedic Research Society
12:15	Lunch	
13:30	Subject specific finite element models in the application of osteoporosis and osteoarthritis	Dr Shannon Li, WP lead in MULTISIM
14:00	Mechanical interplay across the osteochondral junction	Prof Andrew Pitsillides, Lead in OATech+ network
14:30	Round-table discussion: Evaluation and development of new treatments for osteoarthritic joints by combining computational modelling and experimental methods.	
15:00	Refreshments	
15:30	Flash presentations	Participants will give a 3 minute summary of their research
17:30	End of day 1	
18:30	Evening meal and drinks at the University Arms (Day 1-4 competition participants only)	

Day 2-4 Modelathon Competition

Modelling competition event details

The event will commence on Day 1 with a symposium where participants will have the opportunity to present their work as a 3-minute presentation. The symposium will be held in Workroom 1 on the second floor of the Diamond.

On the morning of Day 2, the participants will be introduced to the challenges and the data and compute infrastructure. They will have opportunity to familiarise themselves with the infrastructure before the challenges begin.

After lunch on Day 2, the participants will be divided into teams of mixed expertise. The teams will be sent to their allocated workspaces to discuss and start to solve the multiscale modelling challenges.

On the morning of Day 3, the second set of challenges will be issued, building on the results of the challenges from Day 2.

Experts will be on hand to answer questions, give advice and provide a focus for ideas. However, each team must independently come up with their own solution strategy.

Oral presentations before a panel of experts will take place on the morning of Day 4. Each team will be allowed 15 minutes for a presentation explaining their strategy, whether successful or not, and 5 minutes will be allocated for questions. The members of the winning team will be presented with a prize.

Day 2	Tuesday, 14 January 2020	
Modelathon Competition		
Computer Room 3, Level 2, The Diamond (all day, except breaks)		
09:00	Welcome	Dr Enrico Dall’Ara, MultiSim Group Leader, University of Sheffield
09:15	Challenge #1 – Introduction	MultiSim organising committee
09:30	Challenge #2 - Introduction	MultiSim organising committee
09:45	Challenge #3 – Introduction	MultiSim organising committee
10:00	How to use the infrastructure	Andrew Esser and Will Griffith
10:30	Refreshments	Workroom 1, Ground Floor, The Diamond
11:00	Log in and data retrieval exercise	All
11:30	Familiarisation with infrastructure	
12:00	Lunch	Workroom 1, Ground Floor, The Diamond
13:00	Day 2 expertise groups formed for Day 2 challenges	
15:00	Refreshments	Workroom 1, Ground Floor, The Diamond
15:30	Day 2 challenges	
18:30	Evening Meal and Drinks	Workroom 1, Ground Floor, The Diamond

Day 3	Wednesday, 15 January 2020	
Computer Room 3, Level 2, The Diamond (all day, except breaks)		
09:00	Day 3 challenges explained	Dr Enrico Dall'Ara
09:15	Day 3 challenges	
10:30	Refreshments	Workroom 1, Ground Floor, The Diamond
11:00	Day 3 challenges	
12:00	Lunch	Workroom 1, Ground Floor, The Diamond
13:10	Day 3 challenges	
15:00	Refreshments	Workroom 1, Ground Floor, The Diamond
15:30	Day 3 challenges	
18:30	Evening Meal & Drinks	Workroom 1, Ground Floor, The Diamond

Day 4	Thursday, 16 January 2020	
09:00	Finalising presentations	Computer Room 3, Level 2, The Diamond
Presentations		
Workroom 1, Ground Floor, The Diamond		
09:30	Introduction to team presentations	Dr Enrico Dall'Ara and Dr Sara Oliviero
09:40	Team #1 Presentation	
10:00	Team #2 Presentation	
10:20	Team #3 Presentations	
10:40	Team #4 Presentation	
11:00	Team #5 Presentation	
11:20	REFRESHMENTS / Presentation deliberations (Closed Session)	Computer Room 3, Level 2, The Diamond
11.50	Winners announced!	Workroom 1, Ground Floor, The Diamond
12:00	Lunch	Workroom 1, Ground Floor, The Diamond
13:00	End	

Feedback

Participants

The table below shows the breakdown of the participants across the years broken down by level. The Modelathon has always had a high proportion of PhD students, this year was almost exclusively PhD students in the Sheffield participants.

Modelathon	Date	Total	PhD Students	PDRAs	Academics	Graduate Students
1	24-16 Aug 2015	25	17 [68%]	8 [32%]	0	0
2	7-9 Sep 2016	22	12 [55%]	10 [45%]	0	0
3	11-14 Sep 2017	28	17 [60%]	10 [36%]	1 [4%]	0
4	17- 20 Sep 2018	15	7 [50%]	6 [43%]	0	1 [7%]
5 (Remote)	13-16 Jan 2020	25 (6)	24 [96%] (1)	1 [4%] (5)	0	0

The table below shows the the breakdown of the participants by the location of the institution that they are from: University of Sheffield, national (UK), European, and international. This year has had the highest proportion of European participants, almost half.

Modelathon	Date	Total	UoS	National	European	International
1	24-16 Aug 2015	25	10 [40%]	10 [40%]	4 [16%]	1 [4%]
2	7-9 Sep 2016	22	12 [54%]	8 [36%]	1 [5%]	1 [5%]
3	11-14 Sep 2017	28	12 [43%]	11 [39%]	5 [18%]	0
4	17- 20 Sep 2018	15	6 [43%]	7 [50%]	1 [7%]	0
5 (Remote)	13-16 Jan 2020	25 (6)	3 [12%]	10 [40%]	12 [48%]	0

Day 1 Symposium

The Day 1 Symposium was introduced in 2017. The feedback from the participants across the years that a Day 1 Symposium was delivered are presented below. The feedback is positive, with less satisfaction associated with the networking and panel discussion this year than in previous years.

Day 1: How well was this year's topic addressed by the presentations?						
	2017		2018		2020	
	Count	%	Count	%	Count	%
Excellently	7	37%	11	92%	12	63%
Mixed but Adequately	12	63%	1	8%	6	32%
Varied and Inadequately	0	0%	0	0%	1	5%
Consistently	0	0%	0	0%	0	0%

Day 1: Which of the following statements would best describe your experience?						
I have made new contacts	2017		2018		2020	
	Count	%	Count	%	Count	%
Strongly Agree	13	68%	9	75%	8	44%
Agree	4	21%	3	25%	9	50%
Disagree	1	5%	0	0%	1	6%
Strongly Disagree	1	5%	0	0%	0	0%
Not Applicable					1	

I was satisfied with the catering	2017		2018		2020	
	Count	%	Count	%	Count	%
Strongly Agree	9	47%	4	33%	12	67%
Agree	6	32%	7	58%	6	33%
Disagree	3	16%	1	8%		0%
Strongly Disagree	1	5%	0	0%		0%
Not Applicable					1	

Modelathon 2020 Report for OATech+



The venue was fit for purpose	2017		2018		2020	
	Count	%	Count	%	Count	%
Strongly Agree	13	68%	12	100%	13	72%
Agree	4	21%	0	0%	5	28%
Disagree	0	0%	0	0%		0%
Strongly Disagree	2	11%	0	0%		0%
Not Applicable					1	

Day 1: How deeply were the issues surrounding the topic covered in the group discussion session?	2017		2018		2020	
	Count	%	Count	%	Count	%
Thoroughly	7	37%	8	67%	6	33%
Adequately	11	58%	4	33%	10	56%
Superficially	1	5%		0%	3	17%
Inadequately	0	0%		0%		0%

Modelathon 2020 Report for OATech+



Day 2-4 Feedback

Participants were satisfied with the *difficulty of the challenges*, the *catering*, the *venue* and the *IT support*. They also reported gaining insight into osteoarthritis tissue modelling, musculoskeletal modelling, finite element modelling and multiscale modelling. All would recommend the Modelathon and all but one would attend the Modelathon again. The Modelathon is well received and is fulfilling its objectives.

Days 2-4: Please choose one of the following that best describes your experience on these ...											
Difficulty of the challenges	2016		2017		2018		2020		Total		Sat &
	Count	%	Count	%	Count	%	Count	%	Count	%	V Sat
Very Satisfied	7	64%	8	44%	4	33%	7	47%	26	46%	88%
Satisfied	2	18%	6	33%	8	67%	7	47%	23	41%	
Somewhat satisfied	2	18%	4	22%	0	0%	1	7%	7	13%	
Not satisfied	0	0%	0	0%	0	0%	0	0%	0	0%	

Catering			2017		2018		2020		Total		Sat &
	Count	%	Count	%	Count	%	Capacity	Count	Count	%	V Sat
Very Satisfied	6	55%	8	44%	4	33%	9	60%	27	49%	87%
Satisfied	5	45%	6	33%	6	50%	4	27%	21	38%	
Somewhat satisfied	0	0%	4	22%	2	17%	1	7%	7	13%	
Not satisfied	0	0%	0	0%		0%		0%	0	0%	
Not Applicable									1		

Venue			2017		2018		2020		Total		Sat &
	Count	%	Count	%	Count	%	Capacity	Count	Count	%	V Sat
Very Satisfied			12	67%	10	83%	9	60%	31	70%	95%
Satisfied			5	28%	2	17%	4	27%	11	25%	
Somewhat satisfied			1	6%		0%	1	7%	2	5%	
Not satisfied			0	0%		0%	0	0%	0	0%	
Not Applicable									1		

Modelathon 2020 Report for OATech+



IT and expert support	2016		2017		2018		2020		Total		Sat & V Sat
	Count	%	Count	%	Count	%	Capacity	Count	Count	%	
Very Satisfied	7	64%	6	33%	9	75%	9	60%	31	55%	84%
Satisfied	3	27%	6	33%	2	17%	5	33%	16	29%	
Somewhat satisfied	1	9%	5	28%	1	8%	1	7%	8	14%	
Not satisfied	0	0%	1	6%		0%	0	0%	1	2%	
Not Applicable											

I have gained a deeper insight into:			Cardiovascular models		Tissue level models		OA Tissue models		Total		Total Agree
			2017		2018		2020				
	Count	%	Count	%	Count	%	Count	%	Count	%	
Strongly Agree			6	33%	3	25%	9	60%	18	50%	92%
Agree			7	39%	8	67%	5	33%	15	42%	
Disagree			4	22%	1	8%	1	7%	5	14%	
Strongly disagree			1	6%	0	0%	0	0%	1	3%	

Musculoskeletal models			2017		2018		2020		Total		Total
			Count	%	Count	%	Count	%	Count	%	Agree
Strongly Agree			9	50%	4	33%	6	40%	19	53%	94%
Agree			8	44%	7	58%	7	47%	15	42%	
Disagree			1	6%	1	8%	2	13%	2	6%	
Strongly disagree			0	0%	0	0%	0	0%	0	0%	

Modelathon 2020 Report for OATech+



Finite element models			2017		2018		2020		Total		Total
			Count	%	Count	%	Count	%	Count	%	Agree
Strongly Agree			2	17%	5	42%	8	53%	15	47%	88%
Agree			7	58%	6	50%	6	40%	13	41%	
Disagree			2	17%	1	8%	1	7%	3	9%	
Strongly disagree			1	8%	0	0%	0	0%	1	3%	

Multi-scale models			2017		2018		2020		Total		Total
			Count	%	Count	%	Count	%	Count	%	Agree
Strongly Agree			8	44%	4	33%	9	60%	21	54%	100%
Agree			10	56%	8	67%	6	40%	18	46%	
Disagree			0	0%	0	0%	0	0%	0	0%	
Strongly disagree			0	0%	0	0%	0	0%	0	0%	

	2016		2017		2018		2020		Total	
Day 2-4 >> Would you recommend the Modelathon to a friend?	Count	%	Count	%	Count	%	Count	%	Count	%
Yes	11	100%	18	100%	12	100%	15	100%	56	100%
No	0	0%	0	0%	0	0%	0	0%	0	0%

	2016		2017		2018		2020		Total	
Day 2-4 >> Would attend our Modelathon again?	Count	%	Count	%	Count	%	Count	%	Count	%
Yes	11	100%	18	100%	10	83%	14	93%	53	96%
No	0	0%	0	0%	2	17%	1	7%	2	4%

Comments

The following comments were collected, which will inform that delivery of future Modelthons.

Further comments on any/ all of the above?
Access to the computer room for non-Sheffield participants needs to be reconsidered. It was difficult for us to even leave the floor where the activity was taking place, as there was rarely staff on the desk to let us through. A small temporary barcode per participant would be a feasible way of solving this problem, and is done by other universities, so I imagine Sheffield has the capacity to do this too.
Finally, in as many words as you wish, please tell us how we could improve our event?
The event was great. if more time to prepare for the presentations on the final day could be given.
Better clarify the criteria to choose the winner team, provide more guidance about what the panel is expecting from each team and explain what will make a team win
I believe the event was excellent - it embraced all the different skills from the participants in different challenges and allowed us to push ourselves through the days. I do not have any other suggestions on how to improve the event .
Not much as the event was pretty excellent.
The accommodation needs informing of the dietary requirements of the participants - there was little to no vegan options at breakfast. Including no alternative milks or butters.
Test the software programmes on the virtual machines beforehand to make sure they run properly. Also the virtual machines were quite slow except the one GPU-enhanced one per team, for a computational modelling competition it might be worth using virtual machines with better processing power.
I don't know, for me it was perfect
Including more remote teams and providing better support for them.
I felt like the integration of tasks 1,2 and 3 didn't really work. Mainly I was working with and asking advice from participants from other groups who were working on the same task as I was, rather than asking people in the same group who were on different tasks.
For the round talk discussion perhaps look to do a speed dating type thing where you'd have 5 min with each academic/presenter rather than a panel having a quite general discussion that wasn't very audience led.
Overall it was really good and enlightening!
I thought it was a quite educational even. But I thought it might be helpful to announce the team allocation before the 3 minute research presentations.
I can understand why the organisers might have decided against it, but as much as one would like to pay attention to every presentation, with so many participants it can be a challenge to remember who did what. So if you go into the presentations with the knowledge of who you are going to be working with, it might help the participants work out their areas of expertise in the distribution of tasks faster.

Finally, in as many words as you wish, please tell us how we could improve our event?

- > An extra day (or half day) on the challenges
- > More open-ended challenges, to improve the diversity of ideas
- > Introductory tutorial sessions for some of the key software (Maybe as a "training" morning, with parallel sessions, before the launch of the challenges)
- > Maybe replace the flash presentations with a poster session, to allow the participants a better opportunity to network while still learning about each other's research.

More time could only enhance what models people are able to put together. That would be my only recommendation.

My only critique would be regarding the learning process which could have been established when using multiple software. In the interest of time (and competition) teams immediately split into groups of expertise.

For example: if you were good at Abaqus this is the program you work with for the duration of the project. While this benefits the team, it would be a greater learning curve to learn a new program such as OpenSim.

It would be nice to not isolate delegates into tables as this doesn't encourage networking between everyone evenly as most people end up just talking to the people at their table

Web article

This is a Word paste-up of the proposed web article to be approved by OATech+ describing the Modelathon, formatting may vary from the web-version.

Researchers successfully tackle a multiscale Osteoarthritic knee challenge – Modelathon 2020



Modelathon Participants and Supporters

The MultiSim, OATech+ Modelathon 2020 took place 13 – 16 January 2020 at the Diamond Building, Sheffield and aimed to provide an opportunity to discuss, network, and practise multi-scale research modelling skills through a hackathon competition with industry software and hands-on support from modelling experts. Modelathon 2020 was attended by 25 multi-scale researchers from a number of leading research-intensive universities. This year for the first time we were joined remotely by a team of 6 researchers from the Human Movement Biomechanics Research Group, in KU Leuven, Belgium. For the second time MultiSim partnered with [OATech+](#) to deliver a Osteoarthritis-based challenge: **Optimisation of interventions for osteoarthritic patients with multi-scale modelling.**

The Modelathon opened with a one-day symposium: **Experimental and computational approaches to optimise the treatment of osteoarthritis**, where the 53 attendees engaged with the following presentations:



Symposium Speakers in order of appearance

Challenges in personalised musculoskeletal modelling: an insight from the MultiSim project, Prof Claudia Mazzà, Director of MultiSim.

A brief overview of the OATech+ Network and research updates about: Linking Biomechanics, Biology and Clinical measures to understand the effects of knee OA and responses to surgery, Prof Cathy Holt, PI of OATech+ network.

Meeting safety requirements of personalised treatment using in silico trials, Prof Richie Gill, President of British Orthopaedic Research Society.

Subject specific finite element models in the application of osteoporosis and osteoarthritis, Dr Shannon Li, MultiSim.

Mechanical interplay across the osteochondral junction, Prof Andrew Pitsillides, OATech+ network.

Followed by a round table discussion on Evaluation and development of new treatments for osteoarthritic joints by combining computational modelling and experimental methods.

Over the next three days the four teams in Sheffield and the the remote team in Leuven, developed and then integrated models at three different scales, musculoskeletal whole body, finite element knee joint and osteoarthritic tissue models, to understand the effects of the progression osteoarthritis and its treatments on the knee joint.



Modelathon leader, Enrico Dall'Ara with the winning team:

Will Henson, *University of Sheffield*,

James Charles, *University of Liverpool*,

Anneke Verbruggen, *National University of Ireland – Galway*,

Oluwasegun Kayode, *University of Leeds*,

Martin Revel, *University of Lyon*,

Conor O'Keeffe, *Trinity College Dublin*,

Zehao Ji, *University of Cambridge*



**Engineering and
Physical Sciences
Research Council**



The Modelathon was hosted and funded by EPSRC projects [OATech+](#) Network (EP/N027264/1) and MultiSim (EP/K03877X/1 and EP/S032940/1)



Endorsed by the [European Society of Biomechanics](#) and the [UK Chapter of the VPH Institute](#)

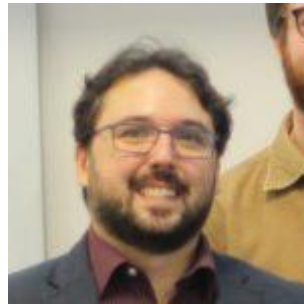


Sponsored and supported by [Ansys](#), [Dassault Systemes](#), [Materialise](#) and [Synopsys](#) and powered by [Google Cloud](#).

100% of respondents to our feedback survey said they would recommend the Modelathon event to a friend.

Here is a selection of quotes from our event's participants on their experience this year.

Keep a look out for details of the Modelathon 2021.



Enrico Dall'Ara

Modelathon Leader, MultiSim, Insigneo, University of Sheffield

I was impressed about the quality of the solutions to the complex multi-scale biomechanical problem that have been presented by our participants this year and what they have achieved during the Modelathon. This is the confirmation that these PhD students and Postdocs will be the next generation leaders in biomechanics.



Clint Davies-Taylor

Director, SIMULIA Academic Development - EMEAR, Dassault Systèmes

Dassault Systèmes is proud to have supported the MultiSim Modelathon since its inception in 2015. Following its acquisition of Medidata in 2019, Dassault Systèmes has elevated Life Sciences to one of its most important business sectors. So this year's theme is very much aligned with our long-term goals.

This year's Modelathon brought together 31 of the brightest PhD and PostDoc Researchers from around the world, future leaders in their fields, to compete in teams against one another to solve a complex multi-scale modelling problem based around an osteoarthritic knee joint.

My role during the event is to support participants with my knowledge of the software and my experience in the Life Sciences industry. This is as an excellent opportunity to provide participants with a leading portfolio of software to help them reach their goal and, ultimately, that they will use in the future.

I have personally provided the support for each of the Modelathons to date, and I continue to be inspired and excited to see how the teams work together to tackle the challenges.

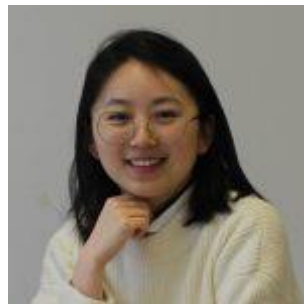
The Modelathon is a unique and inspirational event, and we at Dassault Systèmes are keen to help it flourish.



Claude Hayford

Challenge 1 (Musculoskeletal) Leader, University of Sheffield

This was my first time participating in an event of this sort and although it was challenging, I found the experience worthwhile. It was most fascinating to see how each team approached the different tasks and how they brought their varied expertise to solving a common problem. The biggest highlight for me was the exchange of ideas and networking opportunity this provided. In all, the modelathon was very educative and hands-on and I would recommend it to anyone with an interest in multiscale modelling.



Qiao Li

Challenge 3 (Tissue) Leader, University of Sheffield

I was quite honoured to be involved in the Modelathon 2020 as challenge #3 leader. In the challenge #3, participants were dedicated to model the temporary tissue changes of bone-cartilage complex during the effect of Osteoarthritis. I was amazed by their achievement in such a short time. All of them successfully finished their tasks and some of them even took more effects into consideration. It was indeed an enjoyable experience for me.



Nicos Haralabidis

PhD Student, University of Bath

The MultiSim OATech+ Modelathon provided me with a fantastic oversight of multi-scaling biomechanical modelling, and I have walked away with a much greater understanding of how to integrate the different models. I also particularly enjoyed interacting with my team mates during the challenge and learning new skills from them. The event was superbly organised and was excellent value for money, I will definitely be recommending it to my colleagues.



Satanik Mukherje

PhD Student, KU Leuven, Belgium

Attending the MultiSim OATech+ Modelathon was quite an unique and enriching experience. The Symposium in the first day included interesting talks from leading professors in the OA research. The modelathon was aimed at multiscale modelling of the the knee joint and intervention strategies. During the modelathon, the interesting challenges posed us made the members work together as a team to accomplish the final goals. It was a perfect example to appreciate collaborative research, albeit in a small time frame. I came back with lots of knowledge about multiscale modelling and potential collaborators for future.



Valentin Allard

PhD Student, University of Lyon, France

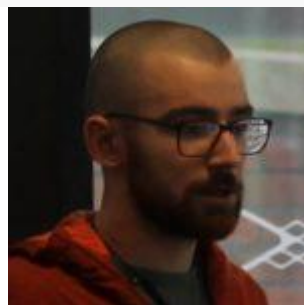
A well-organised event with really nice people, pushing forward your knowledge of biomechanics and software skills in order to solve a complex problem. I recommend it vividly to anyone starting a PhD in biomechanics.



Oluwasegun Kayode

PhD Student, University of Leeds, UK

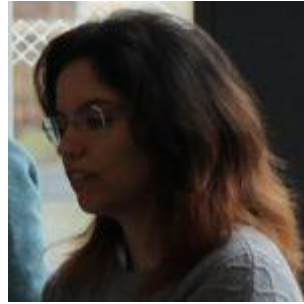
It was really good. I got the opportunity to challenge myself and learn from the other members of my team.



Connor O'Keeffe

PhD Student, Trinity College Dublin, Ireland

Participating in Modelathon 2020 was an amazing experience. As a first year PhD student I felt it was a great opportunity to network, learn new ideas and develop my skills in modelling.



Diana Cruz De Oliveira

PhD Student, University of Birmingham, UK

Modelathon was indeed an amazing opportunity to expand my modelling knowledge beyond my usual research and become familiar with different facets of the world of biomechanical modelling. I enjoyed the challenge of solving a complex multiscale model in a short amount of time, as it allowed me to push myself out of my comfort zone and work with researchers with diverse expertise. The event was well organised and the support offered to us through the competition was extremely valuable. Indeed an awesome opportunity for anyone working in computational modelling!



James Charles

Post-doctoral Research Associate, University of Liverpool, UK

The modelathon provides a perfect environment both learn and improve your knowledge of various modelling techniques. It's also great fun, and is a tremendous networking opportunity, which is invaluable for early career researchers.



Fred Trommer

PhD Student, University of Sheffield, UK

The Modelathon was a very rewarding experience for me. Developing a multiscale model for knee osteoarthritis in a short amount of time was an interesting challenge. It was also a great way to get an overview of a wide range of aspects of biomechanical modelling, to share skills and connect with other researchers in the field. Throughout the event there was excellent organisation and technical support.



Anneke Verbruggen

PhD Student, National University of Ireland, Galway

Modelathon is a refreshing and exciting event, and I am delighted to have participated. Presentations on day 1 indicated to us the sheer variety of research fields and computational methods involved in addressing a single specific health issue like osteoarthritis. This event was a steep learning curve, including lots of unexpected challenges, but the guidance and expertise from software representatives at the event meant each one of us could progress quickly. To think every team addressed this major clinical problem in such a short amount of time is a great confidence boost for those feeling the clock ticking on their own PhD or postdoc projects. Each team had been designated members of different software backgrounds, introducing many of us to programs we had never before encountered. Experts on the final day helped us realise our project outcomes were not just plausible in silico simulations, but had a real potential for clinical application.



Will Henson

PhD Student, University of Sheffield, UK

Being a participant of the Modelathon was a thoroughly enriching experience. The actual goals of the week contextualised and complemented the research I am currently carrying out, showing the power and impact that modelling of the human musculoskeletal system can have. Also, meeting new people from around the world who are carrying out similar research to me is a brilliant thing and I hope to keep in contact with the few I got to know well.

Overall, I would recommend the Modelathon to anyone who believes they have the right set of skills – as the tasks are no joke!



Marissa Britton

PhD Student, National University of Ireland, Galway

Modelathon 2020 was a fantastic experience. Taking part in the challenge was a unique learning experience. It allowed for us to use our previous knowledge and combine it with the knowledge of others on our team, while also learning from one another and the challenge. It was a thoroughly enjoyable event.

Conclusion

The Modelathon was successfully delivered, with high level of satisfaction expressed by the participants and other stakeholders. We look forward to hosting further Modelathons.

The OATech+ contribution was used to cover the costs as described in the proposal, detailed in the Costs and Funding section.

The Modelathon being principally a training event does not possess any results or participants any publication, except the web article reproduced in this report.

Please use extracts of the web article as a public consumable impact statement.

MultiSim is currently seeking funding to cover the next delivery of the Modelathon.