

# Mathematical Modelling in Metallurgical Industry, 19-20 May, Scandic Kristiansand Bystranda

A meeting place for interaction between industry and academia

## Programme – 19 May, 2015

Improved process design and operation by mathematical modelling		
Time	Content, comments	Who
09:00	Registration, coffee/tea/water available	
10:00	Welcome	Klaus Schöffel CEO Teknova
10:05	<b>Metallurgical Scale-up</b> A project focused on four industrial cases	S. A. Halvorsen Teknova
10:30	<b>The use of models in industrial processes – some learning and warnings</b>	Halvard Tveit Elkem
11:00	<b>Through-process-modelling along the Hydro value chain</b> The presentation will give examples of modelling activities in different areas of Hydro's value chain. Extra focus will be given on a methodology for optimisation of processability and properties of aluminium products.	Trond Furu Norsk Hydro
11:30	<b>Multi-scale, multi-physics simulation approach for Al electrolysis</b> As part of a RCN supported project a mixed integrated and coupled simulation approach was developed for deeper insight in bubble and bath flow as well as alumina transport, dissolution and consumption.	Ingo Eick Hydro Aluminium Deutschland
12:00	Lunch	
13:00	<b>Mathematical models for training and operational support</b>	S. O. Wasbø Cybernetica
13:30	<b>Model of an experimental reactor for production of silicon</b>	Jesse White Elkem
14:00	To be determined	NN
14:30	<b>Industrial interaction within mathematics at The University of Oxford</b> Study Groups with Industry, Doctoral Training Centre, ...	Colin P. Please Univ. Oxford
15:30	Break – Coffee, tea, fruit, cakes	
16:00	<b>Industrial challenges – two or three short presentations</b>	From industry
16:30	<b>Industrial challenges – Group work</b>	
17:15	<b>Industrial challenges – Summing up, discussion</b>	
19:30	Dinner	

Programme changes may occur

## Programme – 20 May, 2015

Mathematical modelling for metallurgy – Techniques, basic results and case studies		
Time	Content, comments	Who
8:00	Basic thermal scale-up	S. A. Halvorsen Teknova
8:30	Electrical scale-up	NN Teknova
9:00	Electrical scale-up of a slag heating furnace	Dolores Gómez Pedreira USC/ITMATI
9:30- 10:30	Break – Coffee/tea, ... Check-out from the hotel	
10:30	Mathematical modelling in sedimentation of metal droplets	José Luis Ferrín USC/ITMATI
11:00	Modelling of metallurgical processes Examples from SINTEF	Jan Erik Olsen SINTEF
11:30	Industrial pragmatic modelling How to select the proper level of complexity for industrial challenges	S. T. Johansen SINTEF
12:00	Lunch	
13:00	To be determined	NN
13:30	SFI Metal Production – Focus on Mathematical Modelling	Aud N. Wærnes SINTEF
14:00	Final remarks/Summing up	
14:30	End	

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## About the guest speakers from UK and Spain and their institutions

**Colin P. Please** is Professor of Applied Mathematics at University of Oxford. Teknova is cooperating with Professor Please and other mathematicians through the Oxford Centre for Industrial and Applied Mathematics (OCIAM), a part of the Mathematical Institute at the University of Oxford. University of Oxford is at the forefront of interdisciplinary applied mathematical research, collaborating heavily with numerous university departments and industry. Its members played key roles in a number of major activities including: the foundation of an intermediate research support organization (the Smith Institute) that evolved into the Knowledge Transfer Network (KTN) for Industrial Mathematics; the early realization of the importance of mathematics in the finance industry, which led to the creation of the Nomura Centre for Mathematical Finance; promoting research facilitation and technology transfer, which have been key ingredients in taking UK problem-solving mathematics into the 21st century; founding the European Journal for Applied Mathematics (EJAM), the Mathematics-in-Industry Information Service (MIIS), and the Mathematics-in-Industry Case Studies (MICS) Journal (based at the Fields Institute, Toronto). Oxford is one of the UK nodes for ECMI, which promotes the training of industrial mathematicians in Europe.

Professor Please has been active in the European Study Groups with Industry (ESGI). The Study Group concept originated in Oxford University in 1968. The Study Groups have gained significant academic and industrial influence, first in the UK and subsequently in wider Europe and are closely connected with the European Consortium in Industrial Mathematics (ECMI), that has a mission to connect mathematical research with industrial partners. The main element of a Study Group is a one-week intense workshop meeting at which industrialists initially present problems to academics and the remainder of the week is spent in scientific discussions to model aspects of the problems mathematically. Study Groups provide a unique forum in which established academic mathematicians, postdoctoral researchers and postgraduate students can interact directly and intensively with industrial scientists on real-world problems to identify areas where mathematical ideas can be effective.

Professor Please is one of the two co-directors of Oxford's EPSRC Centre for Doctoral Training (CDT) in Industrially Focused Mathematical Modelling (InFoMM). Teknova is one of two "key collaborators" in InFoMM and Elkem is one of the "partner companies".

**Dolores Gómez Pedreira** and **Jose Luis Ferrin** are both Professors of Applied Mathematics at the University of Santiago de Compostela (USC). They are also Affiliated Researchers of ITMATI.

ITMATI (Instituto Tecnológico de Matemática Industrial, Technological Institute for Industrial Mathematics) is a research centre set up as a public consortium with research teams from three Galician universities (Spain) – Universidade da Coruña, Universidade de Santiago de Compostela (USC) and Universidade de Vigo – in the field of Industrial Mathematics (Applied Mathematics, Statistics and Operations Research). Teknova has cooperated with ITMATI through the Research Group of Mathematical Engineering at USC, one of the most important research groups of ITMATI. This group is a leader in applying mathematics to problems in industry, as demonstrated by its key role in various network platforms such as i-MATH, or more recently in the Spanish network of industrial mathematics, math-in.net. Based on the results of their research in the field of partial differential equations, and in particular in numerical solution methods (finite element, finite volume, etc.), the group has tackled problems relating to the simulation of devices and industrial processes, working as a contractor for private companies and also on publicly funded projects.

The research group has been involved in all stages of such projects, from mathematical modelling to the development of software packages, and has included full mathematical and numerical analysis of the equations obtained. The possible application areas for the cross-cutting technologies developed are diverse, ranging from structural mechanics to electro-magnetism, heat transfer, fluid mechanics, combustion and acoustics, and last but not least, valuable financial products. Its clients include companies of different sizes and technology centres. The group has special competence in electromagnetism. Among others, they have developed MaxFEM, a simulation code for such problems.