4th International Workshop on Numerical Modelling of High Temperature Superconductors

11-14th May 2014, Bratislava, Slovakia.
(program updated the 25th April 2014)

Sunday 11th May

17:00 Registration opens
18:00-20:00 Welcome reception at Hotel Tatra

Monday 12th May

8:30-9:00 Welcome address
Enric Pardo, Conference Chairman
Xavier Granados, Chairman of the HTS Modelling Workgroup

9:00-9:45 John Clem memorial session
Session Chair: A. Campbell
A. Campbell, University of Cambridge, United Kingdom
Y. Mawatari, National Institute of Advanced Industrial Science and Technology, Japan
A. Sánchez, Universitat Autònoma de Barcelona, Catalonia, Spain

9:45-10:30 Plenary session
Numerical Methods for Design and Optimization of Fully Superconducting Machines
Philippe Masson, University of Houston, USA

10:30-11:00 Coffee break

11:00-13:00 Slowly Changing Magnetic Fields: Finite Element Methods
Session Chairs: A. Morandi, L. Prigozhin

11:00 Identification of key numerical parameters for improving the computational performances of finite element solutions of highly non-linear eddy current problems
R. Rivard1, V. Lahtinen2, S. Dufour1, F. Sirois1
1Polytechnique Montreal, Canada
2Tampere University of Technology, Finland

11:30 Adaptive space-time finite element method: Toward effective reduction of degrees of freedom for simulating HTS devices
A. Wan, M. Laforest, F. Sirois
Polytechnique Montreal, Canada

11:50 Recent developments in DC models of superconductors and their application to the design of cables and coils
V. M. R. Zermeno1, P. Krüger1, F. Sirois2, M. Takayasu3, F. Grilli1
1Karlsruhe Institute of Technology, Germany
A modelling tool for simulating hysteresis losses in superconductors utilizing an H-oriented finite element method formulation with cohomology basis functions

V. Lahtinen\textsuperscript{1,2}, A. Stenvall\textsuperscript{1}, F. Sirois\textsuperscript{2}, M. Pellikka\textsuperscript{1}
\textsuperscript{1}Tampere University of Technology, Finland
\textsuperscript{2}Polytechnique Montreal, Canada

Modeling experimental magnetization cycles by finite element simulations

G. Iannone\textsuperscript{1}, G. De Marzi\textsuperscript{2}, S. Farinon\textsuperscript{3}, P. Fabbricatore\textsuperscript{3}, U. Gambardella\textsuperscript{1}
\textsuperscript{1}University of Salerno, Italy
\textsuperscript{2}ENEA C. R. Frascati, Italy
\textsuperscript{3}INFN-Sezione di Genova, Italy

13:00-14:00 Lunch
14:00-15:10 Poster session

P1 Simulation of current-voltage characteristics of layered HTSC with ferromagnetic defects
V.A. Kashurnikov\textsuperscript{1}, A.N. Maksimova\textsuperscript{1}, I.A. Rudnev\textsuperscript{1,2}
\textsuperscript{1}National Research Nuclear University, Moscow, Russia
\textsuperscript{2}International Laboratory of High Magnetic Fields and Low Temperatures, Wroclaw, Poland

P2 Modelling of chaotic phenomena in Josephson junctions
S. Medvedeva\textsuperscript{1,2}, Yu. M. Shukrinov\textsuperscript{2}
\textsuperscript{1}Moscow Institute of Physics and Technology, Russia
\textsuperscript{2}Bogoliubov Laboratory of Theoretical Physics of the JINR, Dubna, Russia

P3 Modelling of hybrid superconducting magnetic screen based on solid BSCCO cylinder and YBCO tape
Ł. Tomków, M. Ciszek
Wroclaw University of Technology, Poland

P4 Quench analysis in a system of LTS outsert solenoidal coil and HTS insert coil
N. Glowa, R. Wesche, P. Bruzzone
EPFL-CRPP Fusion Technology, Lausanne, Switzerland

P5 Mathematical modelling of two parallel Josephson junctions stacks
I. R. Rahmonov\textsuperscript{1,2}, Yu.M.Shukrinov\textsuperscript{1}, P.Seidel\textsuperscript{3}, M.Grajcar\textsuperscript{4}, A. Plecenik\textsuperscript{4}, W.Nawrocki\textsuperscript{5}
\textsuperscript{1}BLTP, JINRResearch, Dubna, Russia
\textsuperscript{2}Umarov Physical Technical Institute, TAS, Dushanbe, Tajikistan
\textsuperscript{3}Institut für Festkörperphysik, Jena, Germany
\textsuperscript{4}Department of Experimental Physics, CU, Bratislava, Slovakia
\textsuperscript{5}Poznan University of Technology, Poznan, Poland
P7  An coupled analysis of the HTS magnet and exciting source in dynamic disturbance
D. Xu  
Shanghai JiaoTong University, China

P8  Numerical modelling of AC losses in HTS tube using an H-formulation
G. Escamez¹,², A. Badel², P. Tixador², A. Allais¹, G. Meunier², B. Ramdane², C.-E. Bruzek¹
¹Nexans/G2ELAB, Grenoble, France
²Université Grenoble Alpes, Grenoble, France

P9  Thermomechanical aspects of superconductor coils
A. Palfavi¹, P. Kis¹, D. Hazelton²
¹Furukawa Electric Institute of Technology
²Superpower, Inc.

P10  In-depth induction heating of large steel slabs by means of magnetic saturation: Modeling and results
A. Morandi, M. Fabbri  
University of Bologna, Italy

P11  Modelling of ReBCO coated conductors in FCL to study the effect of local critical current non-uniformities on overall behavior
A. Badel¹, N. NiDoye¹,², L. Moret¹,², G. Escamez³,¹, P. Tixador¹,²
¹G2Elab - Institut NEEL, CNRS, Grenoble, France
²Université Grenoble Alpes, Grenoble, France
³Nexans/G2ELAB, Grenoble, France

P12  Magnetic field mitigation by superconducting/ferromagnetic coaxial shields
L. Gozzelino¹, R. Gerbaldo¹, G. Ghigo¹, F. Laviano¹, A. Agostino², E. Bonometti²
¹Politecnico di Torino, Italy
²Università di Torino, Italy

P14  HTS SQUID - a tool for teaching
B. Grzesik, M. Stepień  
Silesian University of Technology, Gliwice, Poland

P15  AC loss calculation in a stack of double pancakes of YBCO coated conductor using front track approximation
H. Zhang¹, W. Yuan¹, M. Zhang²
¹Bath University, UK
²Cambridge University, UK

P17  Thermal and Magnetic model of superconducting synchronous motor based on superconducting stacked tapes
M. Baghdadi, M. Zhang, T. Coombs  
University of Cambridge, UK

P18  Critical current uniformity examination of long HTS tape using magnetic-circuit method
S. Zou¹,², C. Gu², T. Qu², X. Li³, Z. Han²,³
Slowly Changing Magnetic Fields: Variational Principles

Session Chair: E. Pardo

15:10 Numerical solution of thin film problems revisited
J. W. Barrett¹, L. Prigozhin², and V. Sokolovsky²
¹Imperial College, London, UK
²Ben-Gurion University of the Negev, Israel

15:40 Modelling current-voltage characteristics of practical superconductors: theory and application
A. Badia-Majos¹, C. Lopez²
¹EINA, University of Zaragoza, Spain
²Universidad de Alcalá de Henares, Spain

16:10 A finite element and massively parallel code for the multi-physics simulation of high temperature superconducting devices
R. Otín, A. F. Martín, S. Badia
CIMNE, Barcelona, Spain

Coffee break

Rotating Machines

Session Chair: B. Dutoit

17:00 Modelling considerations for trapped flux-type superconducting electric machine design
M. D. Ainslie, D. Hu, J. Zou, A. M. Campbell, D. A. Cardwell
University of Cambridge, UK

17:20 Stacks of superconducting tapes based on coated conductors architecture: Bulks substitution?
J. Lopez¹, X. Granados², R. Mayou¹
¹EUETIB (UPC-Barcelona_tech), Barcelona, Spain
²ICMAB-CSIC, Cerdanyola, Barcelona, Spain

17:40 Design and prototype of a trapped flux motor based on stacks of HTS coated conductors
X. Granados¹, J. Lopez², R. Maynou², M. Carrera³
¹ICMAB-CSIC, Cerdanyola, Barcelona, Spain
²EUETIB (UPC-Barcelona_tech), Barcelona, Spain
³University of Lleida, Spain

Tuesday 13th May

Novel Phenomena and Metamaterials

Session Chairs: A. Campbell, A. Sanchez

8:30 Modeling and experimentally realizing superconducting-ferromagnetic metamaterials
A. Sanchez, C. Navau, J.-P. Camps  
*Universitat Autonoma de Barcelona, Spain*

9:00 Magnetization loop modelling for a superconductor/ferromagnetic composite  
F. Gömöry, M. Solovyov, J. Šouc  
*Institute of Electrical Engineering, SAS, Bratislava, Slovakia*

9:20 Analytical Investigation on magnetic-field and current distributions in superconducting strips for modelling of power devices and single-photon detectors  
Y. Mawatari, H. Asai, S. Kashiwaya  
*AIST, Tsukuba, Japan*

9:50 Modeling superconductor-chip-based magnetic traps for ultra-cold atoms  
V. Sokolovsky, L. Prigozhin  
*Ben Gurion University of the Negev, Israel*

10:10 Modeling of resonance and chaotic features of coupled Josephson junctions in high temperature superconductors  
Yu. M. Shukrinov  
*BLTP, JINR, Dubna, Russia*

**10:30-11:15 Coffee break**

**11:15-12:45 Bulk Magnetization**

Session Chairs: Y. Mawatari, B. Vanderheyden

11:15 A direct solution of the critical state based on the physics of flux lines  
A. M. Campbell  
*University of Cambridge, UK*

11:45 Coupled electromagnetic-fluid modelling of a bulk superconductor cooled by a cryogenic fluid  
S. Kirsch¹, J.-F. Fagnard¹, C. Dubois², H. Caps², P. Vanderbemden¹, B. Vanderheyden¹  
¹SUPRATECS, Liège, Belgium  
²GRASP, Liège, Belgium

12:05 Numerical modelling of a bulk HTS staggered array undulator  
*Kyoto University, Japan*

12:25 Split-coil magnetisation of bulk HTS: understanding the mechanisms  
Z. Xu¹, R. Lewin², A. M. Campbell³, D. A. Cardwell³, H. Jones²  
¹KIT, Karlsruhe, Germany  
²University of Oxford, UK  
³University of Cambridge, UK
12:45-13:45  Lunch

13:45-15:15  **Thermal Quench and Mechanical Modelling I**

Session Chairs: F. Sirois, F. Grilli

13:45  Modeling of the resistive type superconducting fault current limiter for power system analysis and optimization

*A. Morandi*, M. Fabbri, B. Gohladz

*University of Bologna, Italy*

14:15  A resistor network model for the analysis of superconducting fault current limiters

*A. Biondini*, H. S. Ruiz, B. Zeimetz, K. Tadinada, T. A. Coombs

*Cambridge University, UK*

14:35  Analysis of the influence of the normal zone propagation velocity on the design of resistive fault current limiters

*D. Colangelo*, B. Dutoit

14:55  Modular quench analysis software development for HTS coils

*E. Härö*, A. Stenvall

*Tampere University of Technology, Finland*

15:15-16:00  Coffee break

16:00-17:00  Organized Discussion

18:00  Conference Dinner & Boat Trip

Gathering point at 17:15 at Hotel Tatra main hall.

**Wednesday 14th May**

8:30-10:00  **Magnets and SMES**

Session Chairs: A. Badia, M. Ainslie

8:30  Numerical evaluation of AC losses in an HTS insert coil for high field magnet during its energization

*K. Kajikawa¹, S. Awaji², K. Watanabe²*

¹*Kyushu University, Japan*

²*Tohoku University, Japan*

9:00  Relaxation effects and AC loss in superconducting windings

*E. Pardo*, J. Šouc, J. Kováč

*Institute of Electrical Engineering, SAS, Bratislava, Slovakia*

9:20  Numerical study of large-scale 2G HTS magnets for very high magnetic field

*M. Zhang¹,², W. Yuan², H. Zhang²*

¹*University of Cambridge, UK*

²*University of Bath, UK*

9:40  Critical currents and electric fields of individual turns of HTS coils

*J. Pitel*, P. Kováč
Institute of Electrical Engineering, SAS, Bratislava, Slovakia

10:00-10:30  **Coffee break**

10:30-11:50  **Thermal Quench and Mechanical Modelling II**

Session Chairs: F. Gömöry, A. Stenvall

10:30  Numerical analysis of a tape-to-tape (2G) interaction under a quench conditions

M. Stepien, B. Grzesik

*Silesian University of Technology, Gliwice, Poland*

10:50  Comparison of a FEM model and a circuit model for the quench analysis of HTS tapes

M. Breschi, M. Casali

*University of Bologna, Italy*

11:10  FEM Modelling of stress-strain state in REBCO Tape under tensile, torsional and transverse load

K. Ilin¹, K.A. Yagotintsev¹, C. Zhou¹, R. Lubkemann¹, T.J. Haugan², D.C. van der Laan³, A. Nijhuis¹

¹*University of Twente, Netherland*

²*US Air Force Research Laboratory, USA*

³*Advanced Conductor Technologies and University of Colorado, USA*

11:30  SEM in situ fragmentation test of REBCO coated layer and numerical simulation of its fracture behavior

K. Konstantopoulou¹, X. Granados², X. Obradors², J. Y. Pastor¹

¹*Universidad Politécnica de Madrid, Spain*

²*ICMAB-CSIC, Campus Universitat Autonoma de Barcelona, Spain*

11:50-12:20  **Discussion Conclusions**

12:20-12:45  **Closing Remarks**

Enric Pardo, Conference Chair

12:45-13:45  **Lunch**

14:00-15:30  **Lab Tour to Institute of Electrical Engineering SAS**