Title: Modelling and numerical simulation of some problems arising in metallurgy.

Abstract:

Various problems that arise in steel production will be presented in the talk. Multiphysics models that govern various aspects of the production of steel in blast furnaces will be presented, as well as in its solidification process. Thus, they will be treated:

- Thermomechanical modelling of the ceramic cup of a Blast Furnace.
- Thermo-hydrodynamic modelling of the flow of pig iron and slag in a Blast Furnace channel.
- The modelling of an inverse problem to control in real time the heat flow through the mould in the steel solidification process.

Numerical simulations of all the processes will be shown.

This is a collaborative work with F. Ballarin, P. Barral, M. Girfoglio, A. Lengomin, U.E. Morelli, B. Nicolás, L.J. Pérez-Pérez, G. Rozza , V. Shah, G. Stabile.

References:

[1] P. Barral – U.E. Morelli – P. Quintela –G. Rozza - G. Stabile. Novel Methodologies for Solving the Inverse Unsteady Heat Transfer Problem of Estimating the Boundary Heat Flux in Continuous Casting Molds. **International Journal for Numerical Methods in Engineering**. 2022. https://onlinelibrary.wiley.com/doi/10.1002/nme.7167

[2] N. V. Shah – M. Girfoglio – P. Quintela – G. Rozza – A. Lengomin – F. Ballarin – P. Barral. Finite element based model order reduction for parametrized one-way coupled steady state linear thermomechanical problems. **Finite Elements in Analysis and Design**. 212, 2022, 1-19. https://www.sciencedirect.com/science/article/pii/S0168874X2200110X?via%3Dihub

[3] P. Barral – L.J. Pérez-Pérez - P. Quintela. Transient thermal response with nonlocal radiation of a blast furnace main trough. **Applied Mathematical Modelling**, 105, 197-225, 2022. https://www.sciencedirect.com/science/article/pii/S0307904X21005977?via%3Dihub

[4] P. Barral – L.J. Pérez-Pérez - P. Quintela. Numerical simulation of the transient heat transfer in a blast furnace main trough during its complete campaign cycle. **International Journal of Thermal Sciences**, 173, 146-159, 2022. DOI: https://doi.org/10.1016/j.ijthermalsci.2021.107349

[5] P. Barral – B. Nicolás - P. Quintela. Numerical Simulation of the Shear Stress Produced by the Hot Metal Jet on the Blast Furnace Runner. **Computers & Mathematics with Applications**, 102, 146-159, 2021. https://www.sciencedirect.com/science/article/pii/S0898122121003618?via%3Dihub

[6] P. Barral – U.E. Morelli – G. Rozza - P. Quintela – G. Stabile. A numerical approach for heat flux estimation in thin slabs continuous casting molds using data assimilation. **International Journal for Numerical Methods in Engineering**. 122, 4541–4574, 2021. https://onlinelibrary.wiley.com/doi/10.1002/nme.6713