dr. Mitrofan Curti

M. Curti is currently an Assistant Professor with the Department of Electrical Engineering, group of Electromechanics and Power Electronics, Eindhoven University of Technology, where he is involved in education and supervision of a team of PhD students and post doctorate researchers. His current research interests include numerical and analytical modeling, analysis, and experimental validation. These developed tools are aimed to optimize Electromechanical and systems within the high precision sector. His work is published in more than 50 peer reviewed articles which resulted from European and national (NL) projects. He received the master's degree from the Warsaw University of Technology and the Ph.D. degree from the Eindhoven University of Technology.

Title: Advances in soft magnetic materials characterization and electric stress prediction for next-generation electromechanics systems

Abstract:

Accurate material property characterization is vital for quantifying losses, performance indicators (force, power, etc.), and spatial field distributions in electrical machines and other high-end equipment. However, challenges arise due to the nonlinear, hysteretic nature of magnetic materials. Working with single valued characterization is an workaround, however this limits the performance prediction. This talk will cover state tools to model hysteresis features of magnetic steel but also machine learning enabled models exploiting neural oscillators and operators. Finally, higher order finite element implementation will be presented to leverage the convergence and overall reduction of computational burden.

Furthermore, in this talk I will reflect on a modelling framework that predicts the electric stress distribution within windings, crucial to address high slew rate power devices which are challenging the insulation design and overall lifetime estimation of electromechanical systems. Accounting for the coil inductive and capacitive coupling, full Maxwell's equations need to be considered. Alternatively, lumped parameter models can be employed, however they face inaccuracies or excessive computational loads when resolving high-turn coils. Recent work highlights a lightweight version of so-called Darwin approximations which couples electric and magnetic fields to address material properties, and high-frequency effects.

This talk bridges theoretical advancements with practical design challenges, emphasizing pathways to integrate cutting-edge modeling strategies into industrial workflows.