SEMINAR

APPLIED MATHEMATICS AND MECHANICS

FS972 2 May 2022

A DCAMM seminar No. 754 will be presented by

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The title of the lecture is

Exact macro-scale models for the design of compact heat transfer devices

Abstract:

Compact heat transfer devices often consist of channels with arrays of periodic solid structures, like offset strip fins, wavy fins or pin fins. For their design, simplified `macro-scale' models are commonly employed to analyze the flow and heat transfer. Typically, these macro-scale models rely on friction factors (or permeabilities) and heat transfer coefficients that have to be calibrated by means of real-life experiments or numerical simulations. Yet, from a theoretical perspective it is not always clear how a consistent calibration can be accomplished, especially since detailed measurements or full-scale simulations of the flow and temperature fields in a device are usually infeasible.
In this lecture, we discuss how physically meaningful friction factors and heat transfer coefficients can be defined for (quasi-) periodically developed flow and heat transfer regimes in micro heat exchangers. Hereto, we describe the flow and heat transfer on a macro-scale level, by means of proper spatial filtering techniques. In addition, we show that for an exact calibration of the latter friction factors and heat transfer coefficients, specific eigenvalue problems can be solved on a unit cell of the array. These eigenvalue problems allow us to reconstruct almost the entire flow and temperature fields in a micro heat exchanger. Finally, we offer a perspective on how our macro-scale models can be combined with state-of-the-art shape and topology optimization methods to optimize the shape and distribution of the solid structures in compact heat transfer devices.

DATE: **Tuesday, 10 May 2022**

TIME: **14:00 – 14:45 incl. questions**

PLACE: **Room 061E, Building 414**
DTU, Technical University of Denmark

Danish pastry, coffee and tea will be served 15 minutes before the seminar starts.

All interested persons are invited.

Niels Leergaard Pedersen