S18 - Heat and Mass Transfer & Transport Phenomena

Organizers: Helmut J. Holl & Yu Ito

When considering processes in automotive and aeronautics or production, the transport of mass, heat and energy is very important. The transported mass can cause vibrations, which influence the whole process and can reduce its efficiency. The change of mass, energy and momentum must be considered carefully for the mechanical modelling in process and chemical engineering, where rotating machines are frequently used. For a proper modelling the application of a control volume and the dimensionless analysis is useful.

The transport phenomena addressed in this session will mainly focus on the vibrations induced by heat and mass transport. Specially pulsating heat transfer in pipes, axial moving materials like belt drives, conveyor belts and transversally loaded beams are subject to vibrations. Typically, the interaction with rotating systems must be considered for the coiling process of strips and sheets. The flow of liquid through moving pipes and other types of fluid-structure interaction present in chemical and biological processes are further subjects for this session. The boundary conditions for moving materials are considered to be non-material. Parametric excitation and stability are important if the variation of the tension force, the length and the motion at the boundary is defined time-dependent. Suitable time-integration algorithms compute an appropriate numerical solution of these non-linear dynamic systems combining first and second order differential equations within a short computation time and guarantee convergence and accuracy of results.

This session provides a frame for researchers, scientists and engineers to exchange information and to present innovative problems in the field of heat and mass transfer as well as transport phenomena.

Non-exhaustive list of suggested topics

- Interaction of moving mass, heat transfer and rotating machinery
- Airfoil heat exchangers and transport devices
- Non-steady state heat transport in pipes
- Axially moving continua
- Moving viscoelastic and viscoplastic materials
- Variable mass systems
- Vibrations of moving belts and band saws
- Spacecraft deploying appendage
- Flexible telescopic manipulators
- Parametric excitation of belt drives
- Dynamics of coiling and spinning processes
- Mass, heat and fluid transport in technical systems

Organizers

Helmut J. Holl is working as an Assistant Professor at the Institute of Technical Mechanics at the Johannes Kepler University of Linz, Austria. He developed a time-integration procedure for the application in nonlinear rotor-dynamic systems including substructuring and variable mass systems. His current research is in the field of the interaction of axially moving structures, fluid-structure interaction and variable mass systems. Furthermore, he holds lectures in rotor-dynamics and numerical and experimental methods in mechanics.

Yu Ito works as an Associate Professor at the Department of Aeronautics and Astronautics at the University of Tokyo. She concurrently serves as a Visiting Associate Professor at Tokyo Institute of Technology, and as a Lecturer at Waseda University. She studied at the University of California, Berkeley. Her specialties are aerospace propulsion systems, gas turbines, turbomachinery, heat exchangers, and heat transport devices, with a focus on compressible flows, cryogenic flows, supercritical fluid flows, and heat transfer between these and solids.

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