On The Solutions of Direct Contact Membrane Distillation Parabolic Systems

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The access to drinking water is getting more and more problematic as a result of the limited natural freshwater resources. Many countries rely on desalination to address their potable water demand. Indeed, desalination has been recognized as one of the most promising approaches to reduce water shortage in arid regions through the production of fresh water from seawater and saline groundwater. Among conventional yet innovative water desalination technologies is membrane distillation (MD). There are different configurations for MD system such as Direct Contact Membrane Distillation (DCMD), Air Gap Membrane Distillation (AGMD), Sweeping Gas Membrane Distillation (SGMD) and Vacuum Membrane Distillation (VMD).
In this talk, we study and analyze the mathematical properties of the model describing heat transfer in the MD process, which is given by a two dimensional advection diffusion parabolic system coupled at the boundary, for more details see [1] and references therein. The framework of semigroup theory has been considered. Using some classical arguments for the analysis of PDEs, the existence and uniqueness as well as regularity are proved. Moreover, the controllability of an advection-diffusion parabolic system coupled at the boundary will be also discussed. Finally, a numerical example based on penalized HUM approach (see [2, 3]) is shown to validate the theoretical results.
This presentation is based on joint work with Taous-Meriem Laleg (KAUST, Saudi Arabia) and Jean Claude Vivalda (INRIA-Nancy, IECL, Université de Lorraine, France).

Références

[1] M. Ghattassi, T-M. Laleg, J-C. Vivalda, *On The Solutions of Systems of Advection Diffusion equations coupled at the boundary*, preprint, 2018.

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[3] M. Ghattassi, T. Takahashi, *On the null-controllability of a radiation-conduction-convection heat transfer system*, to appear, 2018.

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