TRANSIENT CONDUCTO-RADIATIVE HEAT TRANSFER IN A SINGLE MONTE-CARLO ALGORITHM: HANDLING THE NONLINEARITY

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ABSTRACT. It was recently shown that the Green formulation of transient coupled heat transfer could be turned into a Monte-Carlo algorithm that adresses the solution in a direct manner, without iterating between the modes, i.e. sampling heat-transfer paths that combine conduction, convection and radiation at the lower level. The main benefit of such an approach is that the temperature at a given location and a given time can be evaluated without constructing the whole temperature field. There is a strong similarity with standard radiative transfer Monte-Carlo algorithms that evaluate the specific intensity at a given location and in a given direction without constructing the whole intensity field (backward tracking of a radiative path from the observation location to the radiative sources). Here, heat-transfer paths are tracked backwards in both time and space, allowing a straightforward use of computer graphics tools developed for the cinema industry for the evaluation of temperature inside complex industrial geometries. However, as Green formalism is used from the start, this method is limited to linearised heat-transfer, notably to limited temperature differences, so that radiative transfer can be linearised around a reference temperature. We propose a new branching-path sampling approach that bypasses this constraint. In this poster, we explain the formal developments to obtain the Monte-Carlo algorithm and we present one implementation in complex geometry conducto-radiative configurations, leading to a first-level discussion of this observed numerical behaviour in terms of both computation time and branching statistics.

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