Numerical simulation of steady states associated with thermomechanical processes - Application to welding

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ABSTRACT

The numerical simulation of thermo-mechanical processes rests on the modeling of the couplings between several physical phenomena such as heat transfer, metallurgy and mechanics. The classical time-stepping methods enable accurate predictions of the physical variables but are generally long and costly because these processes often involve moving loadings leading to fast evolutions and high gradients of the physical variables, and consequently to the choice of very small time steps.

In numerous situations, the thermal, mechanical and metallurgical fields associated with thermomechanical processes involving moving loadings can reach steady states. Several authors have therefore proposed eulerian or mixed lagrangian-eulerian methods of calculation to determine directly or incrementaly the steady states (see for example [1][2][3]).

In this paper, we propose to compare two approaches of calculation of the steady states associated with the welding process: an incremental approach and an eulerian approach where the constitutive equations of path dependent materials are integrated along streamlines. Advantages and drawbacks of both methods are discussed.

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