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Thermal andlfuid fow modeling oflthelmolten pool behavior duringlTIG welding bylstream vorticity method

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Abstract: The present paper deals with the numerical simulation of weld pool development in Tungsten Inert Gas (TIG) process. A mathematical model is developed in order to solve the Navier–Stokes equations expressed in the stream–vorticity formulation coupled with heat equation taking into account the liquid solid phase change. Using the stream–vorticity formulation in incompressible fuid fow, the same problem is solved with reducing the number of transport equations. Therefore, only one transport equation (vorticity) and one Poisson equation (stream) are considered in this model. The FORTRAN programming and the numerical simulation are then achieved using appropriate discretization that ensures the convergence of the numerical methods to solve a large and sparse linear algebraic systems. Furthermore, to solve the radiation phenomena during welding described by the Stefen law, another method is proposed. Thefobtained numerical results are discussed and validate with experimental.

Keywords : Thermal and fuid modeling, TIG welding, Stream vorticity, 304L steel, Numerical simulation