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Optimal Control of Flows in Moving Domains[1] BARTOSZ PROTAS, WENYUAN LIAO, McMaster University, DONN GLANDER, GM Technical Center — This investigation concerns adjoint–based optimization of viscous incompressible flows (the Navier-Stokes problem) coupled with heat conduction involving change of phase (the Stefan problem) and occurring in domains with moving boundaries such as the free and solidification surfaces. This problem is motivated by optimization of advanced welding techniques used in automotive manufacturing. We characterize the sensitivity of a suitable cost functional defined for the system with respect to control (the heat input) using adjoint equations. Given that the shape of the domain is also a dependent variable, characterizing sensitivities necessitates the introduction of "non-cylindrical" calculus required to differentiate a cost functional defined on a variable domain. As a result, unlike the forward problem, the adjoint system is defined on a domain with a predetermined evolution in time and also involves ordinary differential equations defined on the domain boundary ("the adjoint transverse system"). We will discuss certain computational issues related to numerical solution of such adjoint problems.

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