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The moving contact line problem. Is there a solution? DAVID SIBLEY, ANDREAS NOLD, NIKOS SAVVA, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London — The moving contact line problem occurs when one fluid replaces another as it moves along a solid surface, a situation arising in a vast range of applications. The apparent paradox of motion of the fluid-fluid interface, yet static fluid velocity at the solid satisfying the no-slip boundary condition, has been known for a number of decades, with a wealth of publications suggesting methods to resolve it since. Here we consider the behaviour of a solid-liquid-gas system near the three-phase contact line using a diffuse-interface model with no-slip at the solid and where the fluid phase is specified by a continuous density field. We first obtain a wetting boundary condition on the solid that allows us to consider the motion without any additional physics. Careful examination then of the asymptotic behaviour as the contact line is approached is shown to resolve the moving contact line problem. Various features of the model are scrutinised alongside extensions to incorporate slip, finite-time relaxation of the chemical potential, or a precursor film at the wall. But these are not necessary to resolve the moving contact line problem.

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