Temperature Fields Generated by a Circular Heat Source (CHS):
Thin Film Measurement by Means of Contact Resistance

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The temperature fields created by a circular heat source (CHS) are derived for the case of a CHS embedded inside two identical and isotropic semi-infinite media, when different thermal contact resistances (CRs) are present on each surface of the CHS. Three different temperature fields are derived: the temperature on the CHS surface and in each one of the media surrounding the CHS. The derivation of the 3-dimensional heat flow solution uses first principles with no assumptions. It employs the Hankel and Laplace transforms. Although the analytical solution presented here is exact with no approximations, it is given in an integral form, which requires numerical evaluation. The application of the solution to thin film thermal conductivity virtual measurements is demonstrated. Finite element simulations performed in COMSOL Multiphysics are provided and compared with the analytical solution. Regressions of the COMSOL data show an excellent match between the actual and theoretically-predicted CR, which is readily translated into the thin film thermal conductivity.