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New methods for the analysis of the temperature evolution in and around thermal dual probes for space applications

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The measurement of thermal properties of materials is a great challenge when performed under adverse conditions like space applications, for instance on the surface of moons or comets, which prohibit the use of fragile needle probes. Usually ruggedized sensors are needed (e.g. thick single cylinder probes as used for the Apollo missions).In this case the standard line heat approach is no longer a good approximation. However, recently quasi-analytic mathematical methods were developed which enable the accurate description of dual probes with thick cylindrical bodies. Such sensors are suitable also for harsh measurement conditions, and so very good candidates for future space applications for the measurement of thermal conductivity and heat capacity of planetary and small body surface materials. We compare different methods for the description of such sensors and discuss their respective advantages, restrictions and favorite application scenarios.