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IDENTIFICATION OF THERMAL CONDUCTIVITY OF BIOLOGICAL MATERIAL BY INVERSE PROCEDURE

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Abstract. It is key issue for the Agricultural Engineering to identify thermo physical properties of biological materials. There is a special interest in the thermal conductivity and diffusivity coefficient estimation. A numerical inversion procedure can be applied for determining the thermal properties, using data obtained from a specific experimental framework and from the theoretical data obtained from some mathematical model. The unknown properties is computed by minimizing a functional: the square difference between experimental and modeling data. The experimental data of temperature were previously obtained from a thermal measuring system consisting of concentric cylinders to hold the biological material (a soybean sample in this study), with a heat source placed at the central axis and keeping the cylindrical, as well the circular cross sectional outer surfaces insulated . In such a procedure, only radial heat transfer is effective, minimizing the heat flux in the axial direction. Simulated data of temperature are obtained by using the mathematical model based on the Fourier's law with initial and boundary conditions according to the experimental procedure, which requires estimative of effective thermal conductivity. The effective thermal conductivity is a weighted average between the soybean and air conductitities. Therefore, there are two unknowns to be determined: the effective thermal conductivity and the weight of the soybean in the average. The direct problem is solved by using an implicit forward time and centered space finite difference scheme, with Neumann boundary at the center and the outer surface. The thermal property is estimated by computing the value having the best agreement.