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Recent Developments in the Field of Magnetic Refrigeration

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Abstract

Recent research developments in the field of magnetic refrigeration have shown that magnetic refrigeration is much more efficient compared to conventional gas compression refrigeration, as well as free of hazardous materials for heat transfer, including chlorofluorocarbons and ammonia. To find the optimal design parameters of the active magnetic regenerative refrigerator (AMRR) there has been developed several mathematical models for AMRR, which contain the complex physical parameters of the AMRR. In order to be able to develop stable computer simulators of the models, first we have to have the accurate approximation functions for the physical parameters of the AMRR. In particular, it is necessary to develop the most accurate approximation function for the heat capacity of the magnetic material (Gadolinium), Cm = Cm(Tm, H), which depends on the temperature of the material, Tm = Tm(x, t), as well as on the magnetic induction, H = H(t), where t is the chronological coordinate and x is the spatial coordinate. Unfortunately, there is no known exact analytic function for the heat capacity of Gadolinium. The purpose of this research project is constructing a highly accurate natural cubic interpolating spline function for the heat capacity of Gadolinium between 3.769 and 334.341 degree Kelvin by using the experimental measurements at more than 2000 data points.

Keywords
Magnetic refrigeration, the heat capacity of gadolinium, modeling, numerical simulation

Biography
Bakhodirzhon Siddikov is a Professor of Mathematics at Ferris State University, Big Rapids, Michigan, USA. He earned B.S. and M.S. degrees in Applied Mathematics from Kiev State University, Ukraine and Ph. D. in Mathematics from the University of Wisconsin-Milwaukee. He has published journal and conference papers in the field of Applied and Industrial Mathematics. His research interests include solving nonlinear partial differential equations, simulation, and optimization. He is a member of Pi Mu Epsilon National Honorary Mathematics Society.