December 1972 B72-10237

AEC-NASA TECH BRIEF

Thermal Analog Device Reduces Machining Errors

Thermal analog devices predict the thermal expansion and contraction of machine structures subjected to various heat inputs. These analog devices correct the positioning of machine tools to compensate for distortion of the machine frame, thereby avoiding deviation of the tool relative to the workpiece.

Thermal elements are constructed after identifying the heat sources and observing the machine frame response to the temperature variations. Each thermal element consists of a pair of concentric cylindrical sleeves with a central electrical heating coil. One sleeve is a high heat capacity, high thermal conductivity material such as metal; and the other sleeve is a low heat capacity, high thermal resistance material such as plastic foam. Adjusting the thickness of the sleeves gives the element the same thermal resistivity and heat capacity (RC) time constant as the frame or the affected portion of the frame.

A network of the analog devices thermally simulates the machine frame. Devices, which generate an electrical current proportional to the energy released by the error producing heat source, feed the electrical heating coil. Thus, the temperature of the thermal element core corresponds to the heat flow emanating from the source. Thermocouples or strain gauges predict the thermal response of the frame by the temperature or dimensional change of the thermal element inner sleeve. The outputs of these sensors control tool positioning.

Note:

Requests for further information may be directed to:

Mr. Glenn K. Ellis
Technology Utilization Officer
Office of Information Services
U.S. Atomic Energy Commission
Washington, D.C. 20545
Reference: TSP72-10237

Patent Status:

Inquiries concerning rights for commerical use of this information may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Ave.
Argonne, Illinois 60439

Source: E.R. McClure
Lawrence Radiation Laboratory
under contract to
Atomic Energy Commission
(AEC-10080)

Category 08