

ABSTRACT

Nuclear irradiation introduces dimensional changes in fuel subassemblies. The Profilometer, under consideration, is an equipment used for measuring these changes in the Fast Breeder Test Reactor's hexagonal Fuel Sub Assembly(FSA).

The profilometer consists of a mechanical bed with two guides on which a saddle moves in the $\pm X$ directions. This is driven by a lead screw, guided by a guide bar and powered by a stepper motor. A carriage mounted on top of this carries the Linear Variable Differential Transformer(LVDT) to read the face-to-face dimensions to an accuracy of 0.008mm. Held to this on the same elevation, but a certain distance away is a dial gauge which reads the bow to an accuracy of 0.1mm. Fixed on the bed is a vernier which measures the length to an accuracy of 0.2mm.

For calibration, a dummy FSA was held on the headstock and supported on the tailstock. The face-to-face dimensions were read with a digital micrometer and compared with the LVDT reading and the bow with a dial gauge of better accuracy and compared with the one chosen for profilometry. All the above said measurements were taken on all the six faces of the FSA by indexing it twice, each time by 120°. The concurrence of the values showed that the equipment was calibrated and that it could be directly used for measurements.

Chapter 1 gives a brief introduction to nuclear fuel elements and discusses about hot cells where profilometry would be performed.

Chapter 2 starts with a general literature survey on metrological measurements and also makes comparative review of profilometers for similar applications in use in different laboratories in the world.

Chapter 3 deals with the theoretical work done towards finalisation of present design and explains how the dimensions of interest would be measured.

Chapter 4 gives the experimental results and their analysis.

Chapter 5 gives the conclusions and recommendation for future work and further automation in profilometry of radioactive fuel subassemblies.

Chapter 6 gives the references.