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On Studies of Low Cycle Fatigue

Sur l'étude de fatigue à basse fréquence

Zu den Untersuchungen über niederzyklische Ermüdung

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Several contributions presented during this conference dealt with the response of structural elements and systems to repeated excursions into the inelastic range. This is an area in which relatively little systematic research has been done in the field of civil engineering structures but has been under extensive investigation in other applications such as automobiles and off-road moving equipment.

Many parts in automobiles and particularly in off-road moving equipment fail because of a relatively small number of very severe overloads. In other words, they fail in low cycle fatigue. Extensive studies of such failures lead to the postulation of the hypothesis that such failures are related to the amount of absorbed energy and, furthermore, that the minimum energy required for failure corresponds to failure in one-half cycle, i.e., to failure under monotonic loading. Thus, for example, for a part stressed in direct tension the area under the monotonic stress-strain curve represents the lower limit of the total energy to failure under low cycle fatigue loading. As the maximum strain on any single excursion into the plastic range decreases, the number of cycles to failure increases and also the part is able to absorb an increasing amount of energy.

Extensive studies of low cycle fatigue have been conducted during the last decade by a research group at the University of Illinois lead by Professor Morrow*. I believe the researchers working on the resistance of structures to earthquake loading will find results of those studies of considerable interest.

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Norman Dowling, "Fatigue Life and Inelastic Strain Response Under Complex Histories For An Alloy Steel," American Society for Testing Materials, Journal of Testing and Evaluation, July 1973, pp. 271-287.

*JoDean Morrow, "Cyclic Plastic Strain Energy and Fatigue of Metals,"

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