Matake	5.36
Normal Stress	5.5

V. Conclusions

The mechanical components are often subject to stresses that vary cyclically over time, with an alternative succession of peaks and valleys in the loading history [14-15]. For example, the rotating members of the engines are subjected to periodic flexion loads due to the high rotation speeds. In this framework, the authors focused on the validation of a numerical model finalized to describe the fatigue behavior of a copper bar in several configurations. In ductile materials such as copper alloys, the failure is localized in the crystalline grains until to the total structural collapse. Experimental tests allowed for the deep investigating of the endurance capabilities under different cyclic loads; they were entirely conducted in the laboratory of Department of Industrial Engineering (Aerospace Section, Università degli Studi di Napoli "Federico II"). As shown in Table III – IV, the strain-based models have a good approximation for very high number of cycle becoming inadequate for LCF. The Fatemi-Socie model, in particular, is very poor in the neighbor of LCF zone. On the other side, the usage factor has been calculated with a good accordance between the three methods demonstrating the capabilities for these models to evaluate numerically the fatigue life for structures. Finally, it must highlighted that the structural arguments relating to pure copper or its alloys not so far found widespread knowledge and depth technical data since very rarely these materials are used with structural purposes; this lack is then even greater as regards the fatigue behavior. Another topic against which is not easy to gain actually bibliographic references or significant normative details is about the mechanical behavior of these materials subjected at high frequency vibrations, especially in the case of a drive motor rotor not easily assimilated to homogeneous elastic bodies. To overcome these uncertainties is therefore necessary to perform analytical checks and then integrated and validated by test evidence as well as by also innovative methods, such as to ensure a physical outcome with a greater accuracy than that one of a simple calculation model. Based on the results, any changes are suggested to prevent or control the non-repeatability of the adverse phenomenon. A potential further development will be to implement a rational approach for the analyzing the crack propagation with particular attention to the evaluation of residual stress as a cause of the fatigue life reduction of the mechanical component.

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