A new creep model directly using the tabulated data and implemented in ANSYS

Wilhelm J.H. Rust *, Kang Shen[†]

Hochschule Hannover University of Applied Sciences und Arts
Faculty II – Mechanical Engineering and Bio Process
Ricklinger Stadtweg 120, 30459 Hannover, Germany

[*]E-mail: wilhelm.rust@hs-hannover.de
[†] E-mail: kang.shen@hs-hannover.de

ABSTRACT

Plastics are increasingly used in highly stressed structural parts in modern constructions. The Time dependency is a crucial part of the material behaviour of plastics and called creep and relaxation. Creep is the increase of deformation under constant load and relaxation is the decrease of tension under constant strain. The both behaviours are usually written in creep law functions in the FE-simulation. In Ansys, there are many creep law functions for the user. The creep law functions in Ansys depend on time, stress, strain and temperature with multiple material parameters. To run a creep simulation, the user must determine a right creep law function and then define the parameters. Therefore, the curve-fitting function in Ansys is needed for the parameter-calculations. The results from the curve-fitting are often too bad to use according to the measured curve. For this reason, the new creep model is implemented in USERCREEP of Ansys. This creep model have the similar functionalities of the creep law functions and directly uses the tabulated data of the measured creep curves. The creep curves can be creep-, relaxation-curves / isochronous curves / creep modulus curves. Not like the classical way that the parameters must be calculated before the simulation, this new creep model presented here uses the curves directly, the curve-fitting function is no longer needed. In this paper, we use the tabulated data to create a 3D stress-creep strain-time surface. This surface is created by bicubically blended Coons Patches. The creep strain is calculated from the interpolation within the surface. Despite the tabulation the differentiability, being necessary for a good convergence is also assured in this model. This creep model is not only constructed for direct time dependence, which is recommended only for constant load, but also for indirect time dependence (strain hardening) which calculates the creep rate as a function of creep strain.

Keywords

creep, material model, tabulated test data, Ansys, Usercreep