Advanced Energy Materials and Research

The phenomenological energy model of orthotropic nonlinear elastic material on the example of rolled sheet of cylindrical tank

Maciej Obstand Dariusz Kurpisz
Poznan University of Technology, Poland

The orthotropic materials are one of the most important construction elements. In many cases the orthotropic is the relic of technological process like plate rolling. Because the mechanical properties of such type of material depend on the chosen she rolling direction, the ability to predict the strength situation is very important, when the material will be destroyed. Very useful can be the strain energy based methods which were used among others in papers and sheet rolling direction of sheet metal ar mechanical properties changes can be important when loaded part of device is under dynamic impacts. Fatigue processes initiatio depends also on local material properties di erences and micro notches. e authors of the presentation applied the strain energy density function for the analytical description of the behaviour of orthotropic material forced in plane state of stress. e described investigation results are presented on a practical example of the back surface of the thin-walled cylindrical tank under the in uence of internal pressure. e material stability assumptions formulated on the basis of the strain energy density function, will be very useful and important in the prediction of failure of material due to a plastic ow and particularity in the assessment of strength of the responsible cylindrical shell. As mentioned, dynamic impacts and fatigue phenomena depend on local material properties and notches shapes. Strain energy based method proposed by authors can be developed and helpful for researchers and engine interested in the design of the responsible constructions. e proposed energy method is universal and can be modi ed for the investigated model of construction and applied materials also unconventional materials such as composites or polymers.

Figure 1: Orthotropic tank

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