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Xue–Feng Liu, Dong–Mei Chang, Bao–Lin Wang, Lan–Rong Cai

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Effect of temperature-dependency of material properties on thermal shock fracture of solids associated with non-Fourier heat conduction

Xue–Feng Liu [a,*], Dong–Mei Chang [b], Bao–Lin Wang [c], Lan–Rong Cai [b]

[a] *School of Aeronautical Engineering, Civil Aviation University of China, Tianjin 300222, People's Republic of China*

[b] *Tianjin Key Laboratory of High Speed Cutting and Precision Machining, Tianjin University of Technology and Education, Tianjin 300222, People's Republic of China*

[c] *Centre for Infrastructure Engineering, School of Computing, Engineering and Mathematics, Western Sydney University, Penrith NSW 2751, Australia*

ABSTRACT

This paper investigates the thermal shock fracture behavior of a cracked semi-infinite medium with temperature-dependent material properties. The medium is subjected to a sudden temperature drop at its surface and all material properties are the functions of temperature. The temperature field and associated thermal stress in the medium without cracking are obtained by using the Laplace transform method and the numerical technology of Laplace inversion. The thermal stress intensity factors at the crack tip are obtained by using the weight function method. The thermal stress intensity factor and crack growth behavior are analyzed numerically by comparing the temperature-dependent model with temperature-independent model. The studies indicate the significance of temperature-dependent material properties on the thermal shock fracture and crack growth behavior of solids for high-temperature applications.

Corresponding author. *E-mail address*: milan6@126.com (Xue–Feng Liu)

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