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Heat Transfer Analysis of Helical Grooved Passages near the Leading Edge Region in Gas Turbine Blade

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Abstract : Gas turbines are highly effective engineered prime movers for converting energy from thermal form (combustion stage) to mechanical form – are widely used for propulsion and power generation systems. One method of increasing both the power output and thermal efficiency is to increase the temperature of the gas entering the turbine. In the advanced gas turbines of today, the turbine inlet temperature can be as high as 1500°C; however, this temperature exceeds the melting temperature of the metal blade. With modern gas turbines operating at extremely high temperatures, it is necessary to implement various cooling methods, so the turbine blades and vanes endure in the path of the hot gases. Merely passing coolant air through the blade does not provide adequate cooling; therefore, it is necessary to implement techniques that will further enhance the heat transfer from the blade walls. It is seen that by incorporating helical grooved passages into the leading edge built on turbulence and higher flow rates through the passages, the blade can be cooled effectively. It seen from the analysis helical grooved passages with diameter 5 mm, helical pitch of 50 mm and 8 starts results in better cooling of turbine blade and gives the best thermal performance.

Keywords : blade cooling, helical grooves, leading edge, numerical analysis
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