Karakteristik perpindahan panas konvektif jet sintetik dengan variasi jarak tumbukan = Convective heat transfer characteristic of synthetic jet with variation of impinging distance

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Abstrak

Dewasa ini, beban panas yang semakin besar akibat meningkatnya kecepatan operasi dan densitas komponen pada suatu piranti elektronik menyebabkan perlunya sistem pendingin baru yang lebih efisien atau mempunyai disipasi panas yang tinggi. Jet sintetik potensial untuk digunakan sebagai pendingin komponen elektronik. Paper ini melaporkan hasil dari studi eksperimental mengenai pengaruh Jarak Tumbukan (impinging distance) pada performa pendinginan dengan tumbukan jet sintetik. Rasio jarak aksial antara permukaan yang dipanaskan dan jet (L) terhadap diameter orifis jet (d) berada pada jangkauan 0-3.3. Investigasi dilakukan dengan menggunakan prototipe jet sintetik yang memiliki 16 lubang dengan diameter tiap lubang 3 mm dan digerakkan oleh dua membran piezoelektrik 5 volt dengan eksitasi gelombang sinusoidal. Dengan sistem aparatus tersebut diteliti karakteristik dari perpindahan panas konvektif yang dihasilkan membran yang berosilasi. Hasil penelitian menunjukkan adanya pengaruh ketinggian orifis yang signifikan terhadap laju perpindahan panas yang didapat. Pada frekuensi eksitasi tinggi 160 Hz, kenaikkan nilai perpindahan sebanding dengan kenaikkan rasio L/d hingga nilai L/d sebesar 2 kemudian turun hingga L/d sebesar 3,3.

.....Nowadays, A greater heat load due to miniaturization of electronic products causes the need for a new cooling system that works more efficient and has a high thermal efficiency, Synthetic jet is potentially useful for cooling of electronic components. In this study, numerical simulations are performed to investigate the effect of various the distance between the orifice and the heated surface (L) on the ensuing synthetic jet flow. In this research the investigation was carried out by comtutational methods using the software CFD (Computational Fluid Dynamics), it will be seen the characteristics of convective heat transfer by moving the synthetic jet membrane. A circular orifice synthetic jet is simulated assuming axisymmetric behaviour. The quality of results is verified by time and convective heat transfer studies, and the results are validated against existing experimental. In this research the model was simulated to examine the distribution of heat flow on the walls using a mathematical turbulen model k-w SST. Meshing order was elements Tet/Hybrid and type Tgrid. The boundary conditions were inlet velocity of 1.5 m/s, 2 m/s and 1 m/s, the frequency of membrane vibration were 80 Hz, 120 Hz, 160 Hz and the amplitude were 1 mm/s, 2 mm/s, 1.5 mm/s. The Reynolds number (Re) is in the range of 1421 – 2843 based on average velocity, while the normalized axial distance varies between 0 and 3.3. The movement of the piezo membrane is assumed of sinusoidal motion

which moves up and down correspond to the suction and blowing phase respectively. The results showed the significant influence of L/D Ratio and sinusoidal wave frequencies to the heat transfer rate that obtained. At small axial distance (L), recirculation of fluid occurs due to confinement, owing to the presence of the orifice plate. However, at large axial distances, the jet velocity reduces due to entrainment of still ambient air, which again reduces the heat transfer coefficient.