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## Passive control of base drag employing dimple in subsonic suddenly expanded flow (Article)

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### Abstract

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This paper presents an experimental and computational investigation to study the effectiveness of dimples to control the base pressure in Backward facing step (BFS) for various Nozzle pressure ratio (NPR) having Compressible flow to minimize the base drag. Two dimples of 3 mm diameter located at 1800 interval along pitch circle diameter of 23 mm in the base region was employed as passive controls. The test was conducted for NPR 1.27, 1.38, 1.52 and 1.69. The model is designed in such a way so as to provide four BFS with angle of incidence as 150 from which the flow suddenly expands to a square duct of 25 mm. The experimental investigation is carried out for different length of duct 4D≤L≤10D to see the influence of geometric parameter on base pressure. From the present investigation, it was found that dimples as passive control is very effective at higher NPR and the wall pressure distribution too was quite stable at higher NPR. Also the geometric parameter was found to influence the base pressure for a particular NPR. Computational investigation using commercial CFD tool shows pressure and velocity distribution profile for both dimple and non-dimple control. Tests are carried out by using Navier-stokes equation, Turbulence model as SST, Reynolds number (Re) =122.56×10$^3$. From this investigation it is clear that for a given nozzle pressure ratio one can find optimum L/D ratio which will result in maximum increase/decrease of base pressure and dimples can be effective passive controller for reducing base drag without disturbing the flow field. © June 2018 IJENS.

### SciVal Topic Prominence

Topic: Coolants | Gas turbines | blowing ratio

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### Author keywords

Backward facing step | Base pressure | Nozzle pressure ratio | Passive control | Wall pressure

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*(2017) 2017 2nd International Conference for Convergence in Technology, I2CT 2017*

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*(2017) 2017 2nd International Conference for Convergence in Technology, I2CT 2017*

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1 Montazer, E., Yarmand, H., Salami, E., Muhamad, M.R., Kazi, S.N., Badarudin, A.
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(2018) *Renewable and Sustainable Energy Reviews*, Part 1 82, pp. 994-1005. Cited 2 times.
doi: 10.1016/j.rser.2017.09.104

View at Publisher

2 Chen, L., Asai, K., Nonomura, T., Xi, G., Liu, T.
A review of Backward-Facing Step (BFS) flow mechanisms, heat transfer and control

(2018) *Thermal Science and Engineering Progress*, 6, pp. 194-216.
https://www.journals.elsevier.com/thermal-science-and-engineering-progress
doi: 10.1016/j.tsep.2018.04.004

View at Publisher

3 Vishwanath, Patil
(1990) *Effectiveness of passive devices for axi-symmetric base drag reduction at Mach 2*

4 Ramamurthy, A.S.
(1991) *Some characteristics of flow past Backward facing steps including cavitation effects*. Cited 2 times.

5 Vishwanath
(1996) *Flow management techniques for base and after-body drag reduction*

6 Biswas, G.
(2004) *Backward facing step geometry, for various expansion ratio LehrstuhlfurStromungsmechanik*
University Erlangen-Nurnberg Cauerstr. 4, D-91058 Erlangen, Germany

7 Tihon, J.
(2012) *The transitional backward-facing step flow in a water channel with variable expansion geometry*
Institute of Chemical Process Fundamentals, Academy of Sciences of the Czech Republic, Rozvojova 135, 16502 Prague, Czech Republic

8 Khan, S.A., Rathakrishnan, E., Ashfaq, S.
(2013) *Control of suddenly expanded flow for area ratio 3.61. An International journal of advanced scientific and technical research*

9 Chaudhary, Z.I., Shinde, V.B., Bashir, M., Khan, S.A.
Experimental investigation on the effectiveness of active control mechanism on base pressure at low supersonic mach numbers

(2017) *Lecture Notes in Mechanical Engineering*, PartF9, pp. 197-209. Cited 3 times.
www.springer.com/series/11236
doi: 10.1007/978-981-10-1771-1_24

View at Publisher

10 Bashir, M., Baig, M.A., Ismail, A.F., Khan, S.A.
Control of Suddenly Expanded Flows from Correctly Expanded and under Expanded Nozzles at Supersonic Mach number for Area Ratio 2.56
*International Organization of Scientific Research-Journal of Mechanical and Civil Engineering (IOSRJMCE)*, pp. 76-82. Cited 5 times.

11 Khan, S.A., Bashir, M., Fharukh Ahmed, G.M., Ullah, M.A.
An investigation of base flow control by wall pressure analysis in a suddenly expanded nozzles
(2016) *International Journal of Scientific Research and Development*, 3 (5), pp. 1-6. Cited 4 times.

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