

# Boundary Condition Implementation

- Implicit BCs are used in PUMA when any of the implicit time-integration schemes are used (i.e. the BC is evaluated at the next timestep as opposed to the current timestep).
- The boundary condition Jacobian  $J_{BC} \left( \frac{\partial Q_{BC}}{\partial Q} \right)$  is obtained numerically using central differences, which is completely general and does much to improve the maintainability of the code.
- There are several types of BCs implemented in PUMA, and more can be added without much difficulty as and when wanted.

Type	Description	Variable values specified
0	Do nothing	
1	Fixed at freestream	
2	Fixed at given values	$\rho, u, v, w, p$
3	First order extrapolation from the interior	
4	Second order extrapolation from the interior	
5	Inflow/outflow (Riemann)	
6	Specified $p_0, T_0$	$p_0, T_0$
7	Fixed back pressure pressure	$p$
8	Tangency	
9	No slip adiabatic wall	
10	No slip fixedtemperature wall $T_{wall}$	$T_{wall}$
11	Zero $u$ velocity	
12	Zero $v$ velocity	
13	Zero $w$ velocity	