User Guide

Contents

A.4 Standard boundary conditions

basic	
calculated	This boundary condition is not designed to be evaluated; it is assmued that the value is assigned via field assignment, and not via a call to e.g. updateCoeffs or evaluate
fixedValue	This boundary condition supplies a fixed value constraint, and is the base class for a number of other boundary conditions
fixedGradient	This boundary condition supplies a fixed gradient condition, such that the patch values are calculated using:
zeroGradient	This boundary condition applies a zero-gradient condition from the patch internal field onto the patch faces
mixed	This boundary condition provides a base class for 'mixed' type boundary conditions, i.e. conditions that mix fixed value and patch-normal gradient conditions
directionMixed	Base class for direction-mixed boundary conditions
extrapolatedCalculated	This boundary condition applies a zero-gradient condition from the patch internal field onto the patch faces when evaluated but may also be assigned. snGrad returns the patch gradient evaluated from the current internal and patch field values rather than returning zero

Table A.7: basic boundary conditions.

constraint	
cyclic	This boundary condition enforces a cyclic condition between a pair of boundaries
cyclicACMI	This boundary condition enforces a cyclic condition between a pair of boundaries, whereby communication between the patches is performed using an arbitrarily coupled mesh interface (ACMI) interpolation
cyclicAMI	This boundary condition enforces a cyclic condition between a pair of boundaries, whereby communication between the patches is performed using an arbitrary mesh interface (AMI) interpolation
cyclicSlip	This boundary condition is a light wrapper around the cyclicFvPatchField condition, providing no new functionality
empty	This boundary condition provides an 'empty' condition for reduced dimensions cases, i.e. 1- and 2-D geometries. Apply this condition to patches whose normal is aligned to geometric directions that do not constitue solution directions
jumpCyclic	This boundary condition provides a base class for coupled-cyclic conditions with a specified 'jump' (or offset) between the values
jumpCyclicAMI	This boundary condition provides a base class that enforces a cyclic condition with a specified 'jump' (or offset) between a pair of boundaries, whereby communication between the patches is performed using an arbitrary mesh interface (AMI) interpolation
nonuniformTransformCyclic	This boundary condition enforces a cyclic condition between a pair of boundaries, incorporating a non-uniform transformation
processor	This boundary condition enables processor communication across patches
processorCyclic	This boundary condition enables processor communication across cyclic patches
symmetry	This boundary condition enforces a symmetry constraint
symmetryPlane	This boundary condition enforces a symmetryPlane constraint
wedge	This boundary condition is similar to the cyclic condition, except that it is applied to 2-D geometries

Table A.8: constraint boundary conditions.

Inlet	
cylindricalInletVelocity	This boundary condition describes an inlet vector boundary condition in cylindrical coordinates given a central axis, central point, rpm, axial and radial velocity
fanPressure	This boundary condition can be applied to assign either a pressure inlet or outlet total pressure condition for a fan
fixedFluxExtrapolatedPressure	This boundary condition sets the pressure gradient to the provided value such that the flux on the boundary is that specified by the velocity boundary condition
fixedFluxPressure	This boundary condition sets the pressure gradient to the provided value such that the flux on the boundary is that specified by the velocity boundary condition
fixedMean	This boundary condition extrapolates field to the patch using the near-cell values and adjusts the distribution to match the specified, optionally time-varying, mean value
fixedMeanOutletInlet	This boundary condition extrapolates field to the patch using the near-cell values and adjusts the distribution to match the specified, optionally time-varying, mean value.

	This extrapolated field is applied as a fixedValue for outflow faces but zeroGradient is applied to inflow faces
fixedNormalInletOutletVelocity	This velocity inlet/outlet boundary condition combines a fixed normal component obtained from the ”normalVelocity” patchField supplied with a fixed or zero-gradiented tangential component
fixedPressureCompressibleDensity	This boundary condition calculates a (liquid) compressible density as a function of pressure and fluid properties:
flowRateInletVelocity	Velocity inlet boundary condition either correcting the extrapolated velocity or creating a uniform velocity field normal to the patch adjusted to match the specified flow rate
freestream	This boundary condition provides a free-stream condition. It is a ’mixed’ condition derived from the inletOutlet condition, whereby the mode of operation switches between fixed (free stream) value and zero gradient based on the sign of the flux
freestreamPressure	This boundary condition provides a free-stream condition for pressure
freestreamVelocity	This boundary condition provides a free-stream condition for velocity
mappedFlowRate	Describes a volumetric/mass flow normal vector boundary condition by its magnitude as an integral over its area
mappedVelocityFluxFixedValue	This boundary condition maps the velocity and flux from a neighbour patch to this patch
outletInlet	This boundary condition provides a generic inflow condition, with specified outflow for the case of reverse flow
outletMappedUniformInlet	This boundary conditon averages the field over the ”outlet” patch specified by name ”outletPatch” and applies this as the uniform value of the field over this patch
plenumPressure	This boundary condition provides a plenum pressure inlet condition. This condition creates a zero-dimensional model of an enclosed volume of gas upstream of the inlet. The pressure that the boundary condition exerts on the inlet boundary is dependent on the thermodynamic state of the upstream volume. The upstream plenum density and temperature are time-stepped along with the rest of the simulation, and momentum is neglected. The plenum is supplied with a user specified mass flow and temperature
pressureDirectedInletOutletVelocity	This velocity inlet/outlet boundary condition is applied to velocity boundaries where the pressure is specified. A zero-gradient condtion is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the flux with the specified inlet direction
pressureDirectedInletVelocity	This velocity inlet boundary condition is applied to patches where the pressure is specified. The inflow velocity is obtained from the flux with the specified inlet direction” direction
pressureInletOutletParSlipVelocity	This velocity inlet/outlet boundary condition for pressure boundary where the pressure is specified. A zero-gradient is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the flux with the specified inlet direction
pressureInletOutletVelocity	This velocity inlet/outlet boundary condition is applied to velocity boundaries where the pressure is specified. A zero-gradient condition is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the patch-face normal component of the internal-cell value
pressureInletUniformVelocity	This velocity inlet boundary condition is applied to patches where the pressure is specified. The uniform inflow velocity is obtained by averaging the flux over the patch, and then applying it in the direction normal to the patch faces
pressureInletVelocity	This velocity inlet boundary condition is applied to patches where the pressure is specified. The inflow velocity is obtained from the flux with a direction normal to the patch faces
pressureNormalInletOutletVelocity	This velocity inlet/outlet boundary condition is applied to patches where the pressure is specified. A zero-gradient condition is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the flux with a direction normal to the patch faces
pressurePIDControlInletVelocity	This boundary condition tries to generate an inlet velocity that maintains a specified pressure drop between two face zones downstream. The zones should fully span a duct through which all the inlet flow passes
rotatingPressureInletOutletVelocity	This velocity inlet/outlet boundary condition is applied to patches in a rotating frame where the pressure is specified. A zero-gradient is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the flux with a direction normal to the patch faces
rotatingTotalPressure	This boundary condition provides a total pressure condition for patches in a rotating frame
supersonicFreestream	This boundary condition provides a supersonic free-stream condition
surfaceNormalFixedValue	This boundary condition provides a surface-normal vector boundary condition by its magnitude
swirlFlowRateInletVelocity	This boundary condition provides a volumetric- OR mass-flow normal vector boundary condition by its magnitude as an integral over its area with a swirl component determined by the angular speed, given in revolutions per minute (RPM)
swirlInletVelocity	This boundary condition describes an inlet vector boundary condition in swirl coordinates given a central axis, central point, axial, radial and tangential velocity

	profiles
syringePressure	This boundary condition provides a pressure condition, obtained from a zero-D model of the cylinder of a syringe
timeVaryingMappedFixedValue	This boundary conditions interpolates the values from a set of supplied points in space and time
totalPressure	This boundary condition provides a total pressure condition. Four variants are possible:
totalTemperature	This boundary condition provides a total temperature condition
turbulentDFSEMInlet	Velocity boundary condition including synthesised eddies for use with LES and DES turbulent flows
turbulentDigitalFilterInlet	Velocity boundary condition generating synthetic turbulence-alike time-series for LES and DES turbulent flow computations
turbulentInlet	This boundary condition produces spatiotemporal-variant field by summing a set of pseudo-random numbers and a given spatiotemporal-invariant mean field. The field can be any type, e.g. scalarField. At a single point and time, all components are summed by the same random number, e.g. velocity components (u, v, w) are summed by the same random number, p; thus, output is (u+p, v+p, w+p)
turbulentIntensityKineticEnergyInlet	This boundary condition provides a turbulent kinetic energy condition, based on user-supplied turbulence intensity, defined as a fraction of the mean velocity:
uniformNormalFixedValue	This boundary condition provides a uniform surface-normal vector boundary condition by its magnitude
uniformTotalPressure	This boundary condition provides a time-varying form of the uniform total pressure boundary condition Foam::totalPressureFvPatchField
variableHeightFlowRateInletVelocity	This boundary condition provides a velocity boundary condition for multphase flow based on a user-specified volumetric flow rate
variableHeightFlowRate	This boundary condition provides a phase fraction condition based on the local flow conditions, whereby the values are constrained to lay between user-specified upper and lower bounds. The behaviour is described by:
waveSurfacePressure	This is a pressure boundary condition, whose value is calculated as the hydrostatic pressure based on a given displacement:

Table A.9: Inlet boundary conditions.

Outlet

advective	This boundary condition provides an advective outflow condition, based on solving DDt(W, field) = 0 at the boundary where W is the wave velocity and field is the field to which this boundary condition is applied
fanPressure	This boundary condition can be applied to assign either a pressure inlet or outlet total pressure condition for a fan
fixedNormalInletOutletVelocity	This velocity inlet/outlet boundary condition combines a fixed normal component obtained from the ”normalVelocity” patchField supplied with a fixed or zero-gradiented tangential component
flowRateOutletVelocity	Velocity outlet boundary condition which corrects the extrapolated velocity to match the specified flow rate
fluxCorrectedVelocity	This boundary condition provides a velocity outlet boundary condition for patches where the pressure is specified. The outflow velocity is obtained by ”zeroGradient” and then corrected from the flux:
freestream	This boundary condition provides a free-stream condition. It is a ’mixed’ condition derived from the inletOutlet condition, whereby the mode of operation switches between fixed (free stream) value and zero gradient based on the sign of the flux
freestreamPressure	This boundary condition provides a free-stream condition for pressure
freestreamVelocity	This boundary condition provides a free-stream condition for velocity
inletOutlet	This boundary condition provides a generic outflow condition, with specified inflow for the case of return flow
inletOutletTotalTemperature	This boundary condition provides an outflow condition for total temperature for use with supersonic cases, where a user-specified value is applied in the case of reverse flow
matchedFlowRateOutletVelocity	Velocity outlet boundary condition which corrects the extrapolated velocity to match the flow rate of the specified corresponding inlet patch
outletPhaseMeanVelocity	This boundary condition adjusts the velocity for the given phase to achieve the specified mean thus causing the phase-fraction to adjust according to the mass flow rate
pressureDirectedInletOutletVelocity	This velocity inlet/outlet boundary condition is applied to pressure boundaries where the pressure is specified. A zero-gradient condtion is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the flux with the specified inlet direction
pressureInletOutletParSlipVelocity	This velocity inlet/outlet boundary condition for pressure boundary where the pressure is specified. A zero-gradient is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the flux with the specified inlet direction
pressureInletOutletVelocity	This velocity inlet/outlet boundary condition is applied to pressure boundaries where the pressure is specified. A zero-gradient condition is applied for outflow (as defined

	by the flux); for inflow, the velocity is obtained from the patch-face normal component of the internal-cell value
pressureNormalInletOutletVelocity	This velocity inlet/outlet boundary condition is applied to patches where the pressure is specified. A zero-gradient condition is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the flux with a direction normal to the patch faces
rotatingPressureInletOutletVelocity	This velocity inlet/outlet boundary condition is applied to patches in a rotating frame where the pressure is specified. A zero-gradient is applied for outflow (as defined by the flux); for inflow, the velocity is obtained from the flux with a direction normal to the patch faces
rotatingTotalPressure	This boundary condition provides a total pressure condition for patches in a rotating frame
supersonicFreestream	This boundary condition provides a supersonic free-stream condition
totalPressure	This boundary condition provides a total pressure condition. Four variants are possible:
totalTemperature	This boundary condition provides a total temperature condition
uniformInletOutlet	Variant of inletOutlet boundary condition with uniform inletValue
uniformTotalPressure	This boundary condition provides a time-varying form of the uniform total pressure boundary condition Foam::totalPressureFvPatchField
waveTransmissive	This boundary condition provides a wave transmissive outflow condition, based on solving DDt(W, field) = 0 at the boundary W is the wave velocity and field is the field to which this boundary condition is applied

Table A.10: Outlet boundary conditions.

Wall

fixedFluxExtrapolatedPressure	This boundary condition sets the pressure gradient to the provided value such that the flux on the boundary is that specified by the velocity boundary condition
fixedFluxPressure	This boundary condition sets the pressure gradient to the provided value such that the flux on the boundary is that specified by the velocity boundary condition
fixedNormalSlip	This boundary condition sets the patch-normal component to a fixed value
movingWallVelocity	This boundary condition provides a velocity condition for cases with moving walls
noSlip	This boundary condition fixes the velocity to zero at walls
partialSlip	This boundary condition provides a partial slip condition. The amount of slip is controlled by a user-supplied field
rotatingWallVelocity	This boundary condition provides a rotational velocity condition
slip	This boundary condition provides a slip constraint
translatingWallVelocity	This boundary condition provides a velocity condition for translational motion on walls

Table A.11: Wall boundary conditions.

Coupled

activeBaffleVelocity	This velocity boundary condition simulates the opening of a baffle due to local flow conditions, by merging the behaviours of wall and cyclic conditions. The baffle joins two mesh regions, where the open fraction determines the interpolation weights applied to each cyclic- and neighbour-patch contribution
activePressureForceBaffleVelocity	This boundary condition is applied to the flow velocity, to simulate the opening or closure of a baffle due to area averaged pressure or force delta, between both sides of the baffle. This is achieved by merging the behaviours of wall and cyclic baffles
fan	This boundary condition provides a jump condition, using the cyclic condition as a base
fixedJumpAMI	This boundary condition provides a jump condition, across non-conformal cyclic path-pairs, employing an arbitraryMeshInterface (AMI)
fixedJump	This boundary condition provides a jump condition, using the cyclic condition as a base
mappedField	This boundary condition provides a self-contained version of the mapped condition. It does not use information on the patch; instead it holds the data locally
mappedFixedInternalValue	This boundary condition maps the boundary and internal values of a neighbour patch field to the boundary and internal values of *this
mappedFixedPushedInternalValue	This boundary condition maps the boundary values of a neighbour patch field to the boundary and internal cell values of *this
mappedFixedValue	This boundary condition maps the value at a set of cells or patch faces back to *this
mappedFlowRate	Describes a volumetric/mass flow normal vector boundary condition by its magnitude as an integral over its area
mappedVelocityFluxFixedValue	This boundary condition maps the velocity and flux from a neighbour patch to this patch
swirlFanVelocity	This boundary condition provides a jump condition for `U` across a cyclic pressure jump condition and applies a transformation to `U`
timeVaryingMappedFixedValue	This boundary conditions interpolates the values from a set of supplied points in space and time
uniformJumpAMI	This boundary condition provides a jump condition, using the cyclicAMI condition as a base. The jump is specified as a time-varying uniform value across the patch
uniformJump	This boundary condition provides a jump condition, using the cyclic condition as a base. The jump is specified as a time-varying uniform value across the patch

Table A.12: Coupled boundary conditions.

Generic

codedFixedValue	Constructs on-the-fly a new boundary condition (derived from fixedValueFvPatchField)

	which is then used to evaluate
codedMixed	Constructs on-the-fly a new boundary condition (derived from mixedFvPatchField) which is then used to evaluate
fixedInternalValueFvPatchField	This boundary condition provides a mechanism to set boundary (cell) values directly into a matrix, i.e. to set a constraint condition. Default behaviour is to act as a zero gradient condition
fixedNormalSlip	This boundary condition sets the patch-normal component to a fixed value
fixedProfile	This boundary condition provides a fixed value profile condition
interfaceCompression	Applies interface-compression to the phase-fraction distribution at the patch by setting the phase-fraction to 0 if it is below 0.5, otherwise to 1
mappedField	This boundary condition provides a self-contained version of the mapped condition. It does not use information on the patch; instead it holds the data locally
mappedFixedInternalValue	This boundary condition maps the boundary and internal values of a neighbour patch field to the boundary and internal values of *this
mappedFixedPushedInternalValue	This boundary condition maps the boundary values of a neighbour patch field to the boundary and internal cell values of *this
mappedFixedValue	This boundary condition maps the value at a set of cells or patch faces back to *this
partialSlip	This boundary condition provides a partial slip condition. The amount of slip is controlled by a user-supplied field
phaseHydrostaticPressure	This boundary condition provides a phase-based hydrostatic pressure condition, calculated as:
prghPressure	This boundary condition provides static pressure condition for p_rgh, calculated as:
prghTotalHydrostaticPressure	This boundary condition provides static pressure condition for p_rgh, calculated as:
prghTotalPressure	This boundary condition provides static pressure condition for p_rgh, calculated as:
rotatingWallVelocity	This boundary condition provides a rotational velocity condition
slip	This boundary condition provides a slip constraint
surfaceNormalFixedValue	This boundary condition provides a surface-normal vector boundary condition by its magnitude
translatingWallVelocity	This boundary condition provides a velocity condition for translational motion on walls
uniformDensityHydrostaticPressure	This boundary condition provides a hydrostatic pressure condition, calculated as:
uniformFixedGradient	This boundary condition provides a uniform fixed gradient condition
uniformFixedValue	This boundary condition provides a uniform fixed value condition
uniformNormalFixedValue	This boundary condition provides a uniform surface-normal vector boundary condition by its magnitude

Table A.13: Generic boundary conditions.