



AD FALCON API Manual

Body Force

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1 Body Force

Body forces apply volumetric loads (e.g., gravity) to a selected set of elements, optionally including water/air contributions for coupled analyses.

1.1 Syntax

FALCON treats section names as case-insensitive and whitespace-insensitive, so these headers are equivalent:

```
% BodyForce
% Body Force
% body_force
```

A body-force definition is written as a single block and terminated with `%%%`:

```
% Body Force
Force <fx> <fy> <fz>
WaterContribution <wx> <wy> <wz>
AirContribution <ax> <ay> <az>
ElementIDs All | <id1> <id2> ...
StartStep <stepId>
LoadType <Type> [Frequency <f>] [PhaseLag <deg>] [DampingFactor <d>] [Step
<stepId>]
TabularData <t1> <m1>; <t2> <m2>; ... # only for LoadType Tabular
Propagate Yes | FinalStep <N>
DisplacementReset End of Step <stepId>
InitialVoidinBF Yes | No
%%%
```

Notes:

- Keyword names inside the section are case-insensitive.
- A trailing `:` after a keyword is allowed (e.g. `Propagate:` / `DisplacementReset:` / `InitialVoidinBF:`).
- `ElementIDs` defaults to `All` if omitted.
- `Propagate` defaults to `Yes` if omitted.

1.1.1 Multiple body forces

To define multiple independent body forces (different element sets and/or different start steps), add multiple `% Body Force ... %%%` sections.

1.2 Keywords

1.2.1 Force

Bulk force vector applied to each element (typically an acceleration direction/magnitude used to form the element body force).

```
Force <fx> <fy> <fz>
```

1.2.2 WaterContribution / AirContribution

Additional body-force contributions for coupled / fully coupled problems.

```
WaterContribution <wx> <wy> <wz>
AirContribution <ax> <ay> <az>
```

1.2.3 ElementIDs

Choose which elements receive this body force.

```
ElementIDs All
ElementIDs <id1> <id2> ...
```

Ranges are accepted.

1.2.4 StartStep (required)

Step where the body force begins.

```
StartStep <stepId>
```

stepId must be a defined @Step ID (and must be ≥ 1).

1.2.5 LoadType

Time variation of the body force.

```
LoadType <Immediate|Ramp|Sinusoidal|DampedSinusoidal|Tabular> [Frequency
<f>] [PhaseLag <deg>] [DampingFactor <d>] [Step <stepId>]
```

- Frequency is required for Sinusoidal and DampedSinusoidal (Frequency > 0).
- DampingFactor is optional for DampedSinusoidal (DampingFactor ≥ 0).

- PhaseLag is in degrees and defaults to 0.
- Step is optional for body forces; if provided it must match StartStep.
- For Tabular, you must also provide a TabularData ... line.

For the meaning of each load type, see [Load Types](#).

1.2.6 TabularData (Tabular load only)

```
TabularData <t1> <m1>; <t2> <m2>; ...
```

Each point is time magnitude. The magnitude is used directly as the body-force load factor.

1.2.7 Propagate

Controls how long the body force remains active.

```
Propagate Yes
Propagate FinalStep <N>
```

- Yes applies from StartStep through the last defined step.
- FinalStep N applies from StartStep through step N.

1.2.8 DisplacementReset

Zero displacement DOFs at the end of a given step.

```
DisplacementReset End of Step <stepId>
```

1.2.9 InitialVoidinBF

If enabled, uses the initial void ratio (rather than the evolving void ratio) when computing densities used in the body-force contribution.

```
InitialVoidinBF Yes
```

1.3 Example

```
% Body Force
Force 0.0 -9.81 0.0
WaterContribution 0.0 -9.81 0.0
AirContribution 0.0 -9.81 0.0
ElementIDs All
StartStep 1
LoadType Ramp
Propagate FinalStep 2
DisplacementReset End of Step 1
InitialVoidinBF Yes
%%%
```

