AD FALCON API Manual

Demonstrative Examples of Load and Propagation Options

Javad Ghorbani

March 26, 2026

Contents

1 Demonstrative Examples of Load and Propagation Options

1.1 Overview

This examples demonstrate the application of multiple load types in individual analyses and showcases a multistep simulation using the **propagation** feature. The geometry and boundary conditions remain consistent across all cases.

Each file focuses on a specific load type, with the final file illustrating the combination of multiple load types in a single simulation.

1.2 File Names and Load Types

1. **Immediate Load** - Immediate Load (see Immediate)
2. **Ramp Load** - Ramp Load (see Ramp)
3. **Sinusoidal Load** - Sinusoidal Load (see Sinusoidal)
4. **Damped Sinusoidal Load** - Damped Sinusoidal Load (see Damped Sinusoidal)
5. **Tabular Load** - Tabular Load (see Tabular)
6. **Multistep with Propagation** - Multistep with Propagation

1.3 Geometry and Boundary Conditions

- **Geometry and boundary condition:** A plane strain 2 m × 2 m rectangular domain similar to **Example 1**.

1.4 Individual Load Type Definitions

1.4.1 Immediate Load (details)

```
% Stress Boundary
@Pressure: ElemId 367 Edgenodes 815 814 813
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Immediate Step 1
Propagate: FinalStep 1
@Pressure: ElemId 365 Edgenodes 813 812 811
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Immediate Step 1
Propagate: FinalStep 1
%%%
```

1.4.2 Ramp Load (details)

```
@Pressure: ElemId 367 Edgenodes 815 814 813
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Ramp Step 1
Propagate: FinalStep 1

@Pressure: ElemId 365 Edgenodes 813 812 811
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Ramp Step 1
Propagate: FinalStep 1
```

1.4.3 Sinusoidal Load (details)

```
% Stress Boundary
@Pressure: ElemId 367 Edgenodes 815 814 813
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Sinusoidal Frequency 1e-5 PhaseLag 0 Step 1
Propagate: Yes
@Pressure: ElemId 365 Edgenodes 813 812 811
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Sinusoidal Frequency 1e-5 PhaseLag 0 Step 1
Propagate: Yes
%%%
```

1.4.4 Damped Sinusoidal Load (details)

```
% Stress Boundary
@Pressure: ElemId 367 Edgenodes 815 814 813
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType DampedSinusoidal Frequency 1e-5 PhaseLag 0 DampingFactor 1.e-4 Step
1
Propagate: Yes
@Pressure: ElemId 365 Edgenodes 813 812 811
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
```

```
LoadType DampedSinusoidal Frequency 1e-5 PhaseLag 0 DampingFactor 1.e-4 Step
1
Propagate: Yes
%%%
```

1.4.5 Tabular Load (details)

```
@Pressure: ElemId 367 Edgenodes 815 814 813
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Tabular
TabularData 0 0; 100000 0.1; 120000 0.7; 150000 1.0; 200000 0.0
Propagate: Yes

@Pressure: ElemId 365 Edgenodes 813 812 811
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Tabular
TabularData 0 0; 100000 0.1; 120000 0.7; 150000 1.0; 200000 0.0
Propagate: Yes
```

1.5 Example of Body Force and Tabular Load in Two Steps

Body Force Followed by Tabular Load in Two Steps - Body Force Followed by Tabular Load

1.5.1 Step 1: Body Force Application

```
@Step 1:
@@SolverType: Direct
@@StartStep: 0
@@StepTime: 100000
@@NumberSteps: 10
@@OutputInterval: 1
@@OutputTypes: Displacement TotalStress
@@BodyForce: Yes
@@UL: No
%%%

% Body Force
Force 0.0 -9.81 0.0
StartStep 1
ElementIDs All
```

```
DisplacementReset: End of Step 1
LoadType Ramp Step 1
Propagate: Yes
%%%
```

1.5.2 Step 2: Tabular Load Application

```
% Step Definitions
@Step 2:
@@SolverType: Direct
@@StartStep: 1
@@StepTime: 100000
@@NumberSteps: 100
@@OutputInterval: 1
@@OutputTypes: Displacement TotalStress
%%%
% Step Definitions
@Step 3:
@@SolverType: Direct
@@StartStep: 2
@@StepTime: 100000
@@NumberSteps: 100
@@OutputInterval: 1
@@OutputTypes: Displacement TotalStress
%%%
% Stress Boundary
@Pressure: ElemId 367 Edgenodes 815 814 813
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Tabular
TabularData 100000 0; 200000 0.1; 220000 0.7;250000 1.0;300000 0.0
Propagate: Yes
@Pressure: ElemId 365 Edgenodes 813 812 811
NormalPressures -100 -100 -100
TangentialPressures 0 0 0
LoadType Tabular
TabularData 100000 0; 200000 0.1; 220000 0.7;250000 1.0;300000 0.0
Propagate: Yes
%%%
```

This demonstrates a two-step process where body forces are applied first, followed by tabular load application.

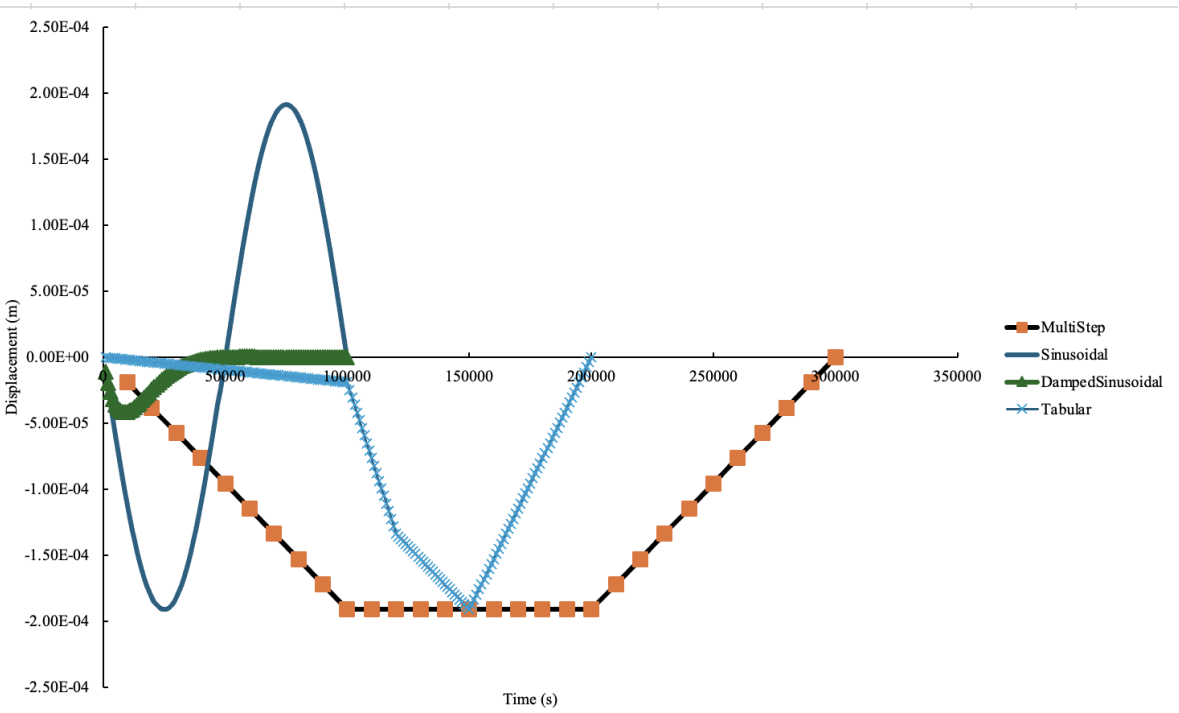

Figure 1: Figure 1: Displacement vs. Time for Various Load Types

1.5.3 Displacement vs. Time

Figure 1: Displacement evolution over time for different load types.

1.5.4 Body Force Example

Figures 2 and 3 illustrate the results of applying a tabular load after body force initialization and geostatic stress establishment.

- **Figure 2** depicts the displacement evolution over time, highlighting the reset of displacement after body force application. This reset restores the geometry to its original configuration while preserving the geostatic stress as the sole remaining component due to the applied body force.
- **Figure 3** presents the vertical stress distribution versus depth at the end of the tabular load. It shows that once the tabular load is fully applied and subsequently removed, the remaining stress field is purely geostatic.

Figure 2: Evolution of displacement over time, emphasizing the reset after body force application.

Figure 3: Vertical stress distribution with depth at the conclusion of the tabular load phase.

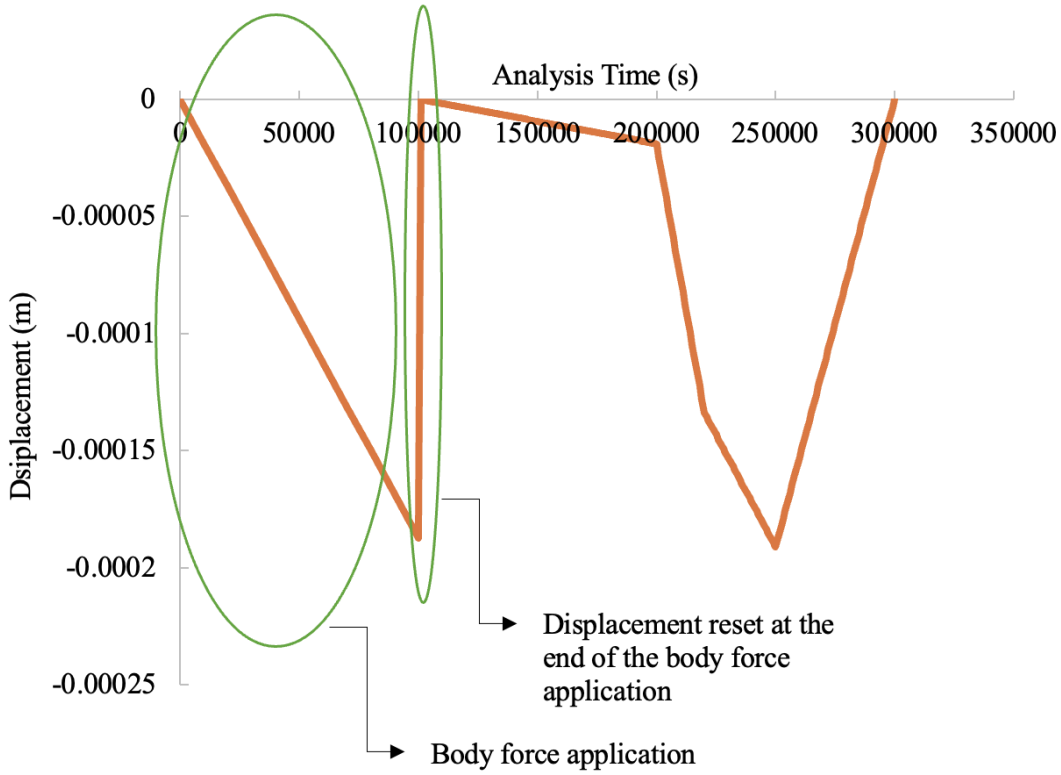

Figure 2: Figure 2: Displacement vs. Time

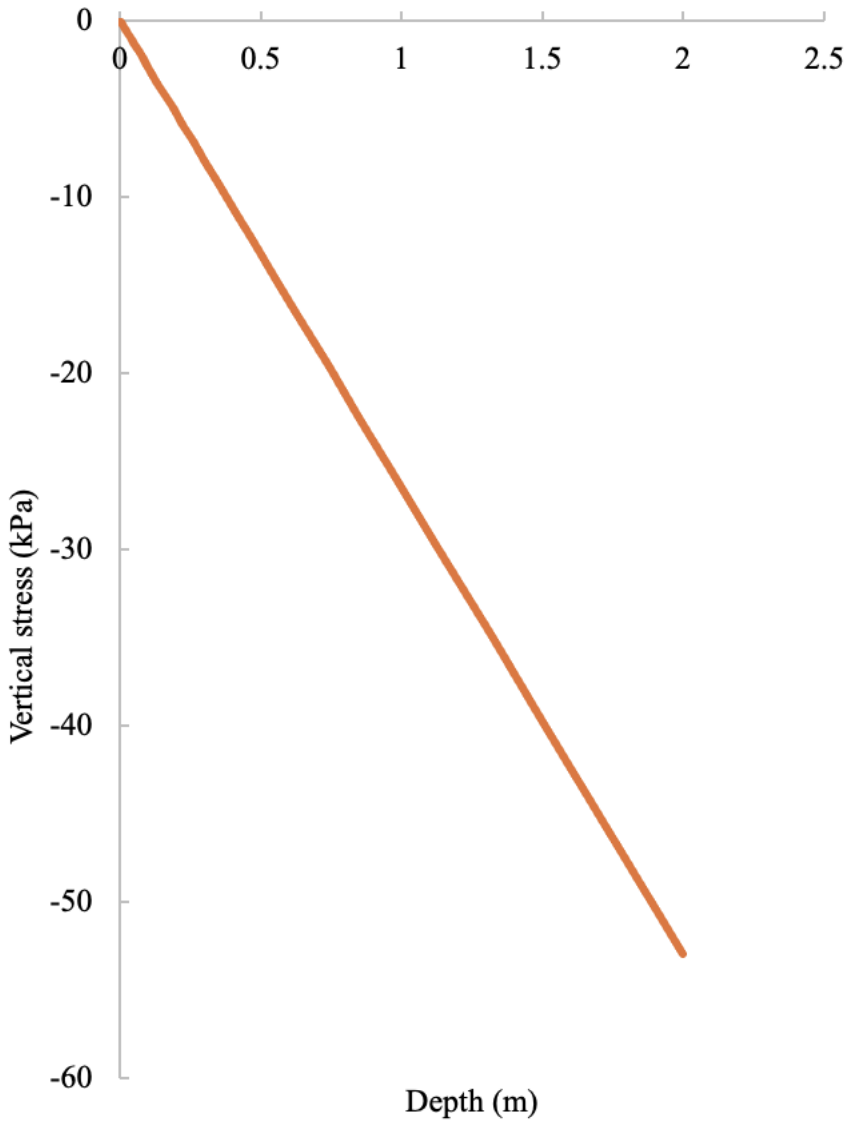

Figure 3: Figure 3: Vertical Stress vs. Depth