



AD FALCON API Manual

Comparison of 1D Wave Propagation in a Saturated Soil Column

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March 26, 2026

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1 Comparison of 1D Wave Propagation in a Saturated Soil Column

[fem_data_1d_sat_dyn.txt](#)

1.1 Problem Description

This study investigates wave propagation in a **1D saturated poroelastic column** with the following conditions:

- **Column height:** 10 m
- **Boundary Conditions:**
 - Bottom: Restrained
 - Sides: Restrained
 - Top: Drained and subjected to an **immediate pressure of 1 Pa**
- **Poisson's ratio:** 0.02 (to mimic 1D behavior)

1.2 Material Properties

1.2.1 Mechanical Properties

- **Young's Modulus:** 2937600.0 kPa
- **Poisson's Ratio:** 0.02
- **Initial Void ratio:** 0.3

1.2.2 Permeability

- **Saturated Permeability coefficient (k_{sat}):** $2.5 \times 10^{-12} m^2$

1.2.3 Phase Characteristics

- **Solid Density (ρ_s):** 2.7 g/cm³
- **Liquid Density (ρ_w):** 0.997 g/cm³
- **Liquid Bulk Modulus (K_l):** 2.25×10^6 kPa
- **Liquid Viscosity (μ):** 1.0×10^{-6} kPa·s

1.2.4 Permeability

- **Anisotropic Permeability Tensor:** $[1 \ 1 \ 1 \ 0 \ 0 \ 0]$

This indicates isotropic permeability in all directions.

1.3 Numerical Approach

The numerical solution is obtained using a **finite element model (FEM)** in a **fully saturated soil column**.

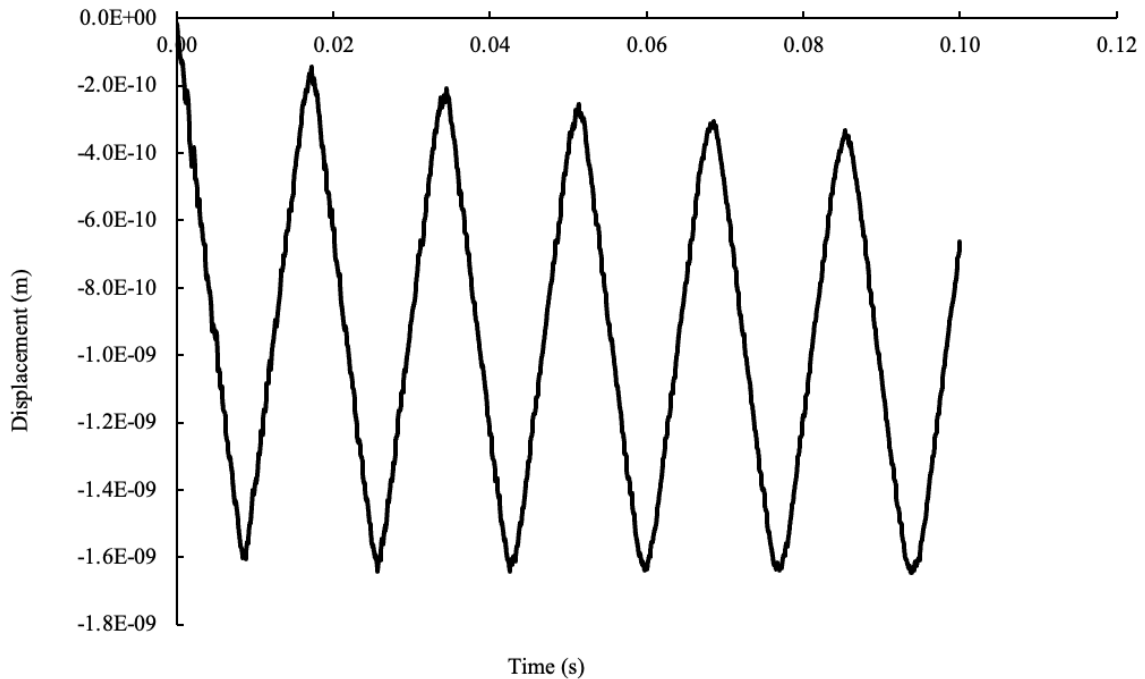


Figure 1: Displacement vs Time

1.4 Comparison with Li & Schanz (2010)

The numerical results for **pore water pressure** and **displacement** are compared with the analytical/numerical solution from **Li and Schanz (2010)**: > **Reference**: Li, P. and Schanz, M. (2011). *Wave propagation in a 1-D partially saturated poroelastic column*. Geophysical Journal International, 184(3), 1341-1353.

1.4.1 Observed Results ($S_w = 1.0$)

- The displacement $u(t, y = 10m)$ vs. time is compared for different saturation levels.
- The **pore water pressure** $p^w(t, y = 0)$ vs. time is analyzed.
- The results from **Li & Schanz (2010)** for $S_w = 1.0$ are used as a benchmark.

1.5 Figures

Below are the numerical results compared with the reference solution:

Figure 1: Displacement vs. Time for Different Water Saturation Levels

Figure 2: Pore Water Pressure vs. Time for Different Water Saturation Levels

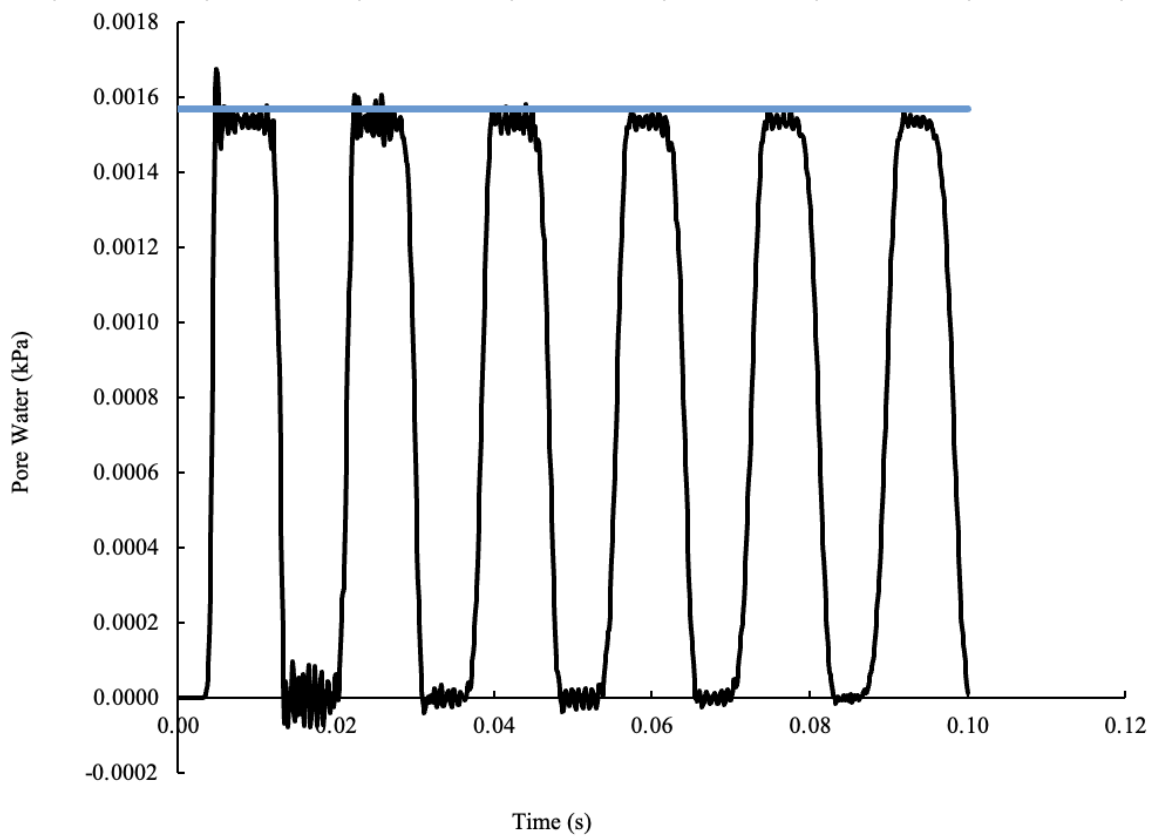


Figure 2: Pore Pressure vs Time