

Acceleration loading

Test Problem

Name:	Acceleration loading
Description:	Demonstrate acceleration loading and validate relative/absolute acceleration, velocity, and displacement.
Program:	SAP2000
Version:	12.0.1
Model ID:	na

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Purpose

The purpose of this test problem on **acceleration loading** is outlined as follows:

- Demonstrate [acceleration-load](#) application
- Demonstrate [absolute/relative](#) acceleration, velocity, and displacement
- Verify SAP2000 results with those obtained from the [Acceleration to displacement record](#) spreadsheet
- Check the ALTADENA-1 acceleration record
- Check one 10-cycle sinusoidal acceleration record

Overview

The attached [SAP2000](#) file features a massless cantilever subjected to a vertical force which represents a concentrated [mass](#) located at its free end. A sinusoidal acceleration [time history](#), defined as the SINE time-history [load case](#), is applied to the system.

The absolute acceleration, velocity, and displacement of the restrained [joint](#) are plotted to obtain the applied ground-acceleration time history, along with its corresponding velocity and displacement records. For the test model given, these records are plotted in Figure 1:

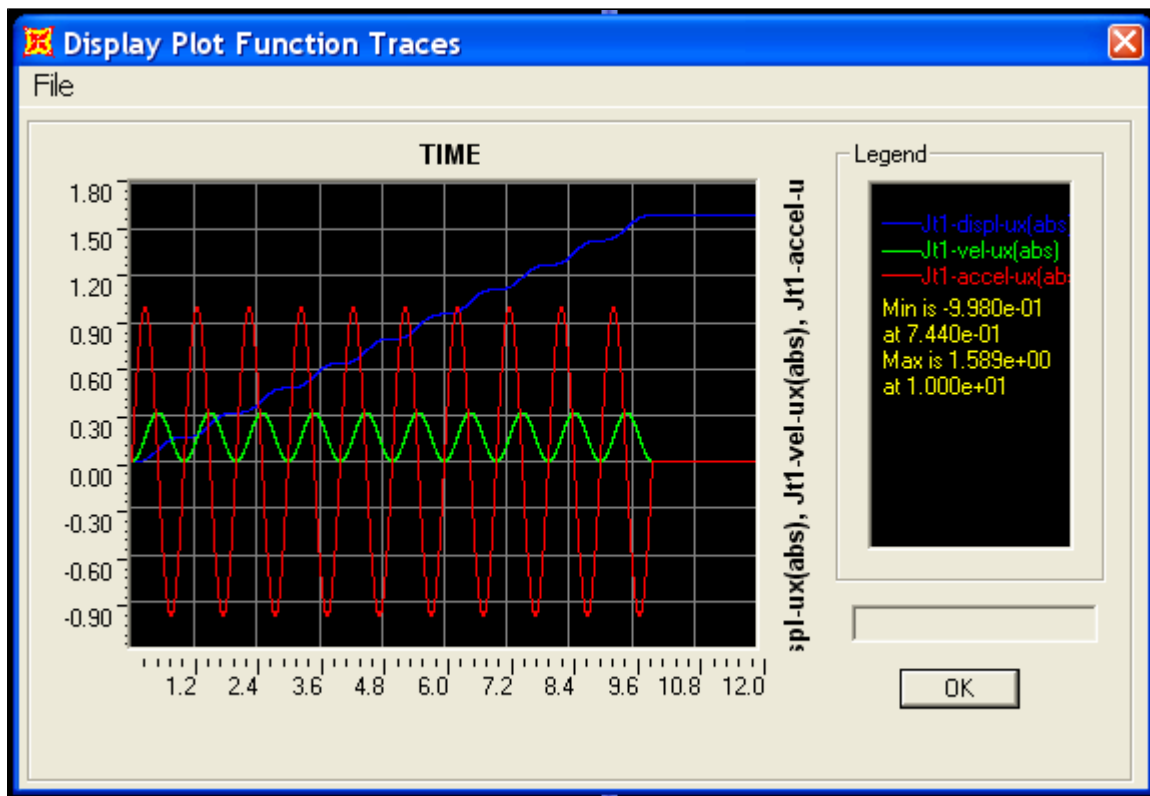


Figure 1 - Sinusoidal acceleration, velocity, and displacement plot

These plots match the values obtained through manual calculation, displayed in the attached [Excel file](#) . This manual calculation follows formulation J.2 of Appendix J in Dr. Edward L. Wilson's text Static and Dynamic Analysis of Structures.

This test problem yields non-zero displacement at the end of the time-history record. Correction using the base line correction algorithm is therefore necessary to establish zero absolute displacement at the unrestrained joint upon conclusion of the record.

Attachments

- [SAP2000 V12.0.1 model](#) (zipped SDB file)
- [Spreadsheet calculation](#) (zipped Excel file)
- [Hand calculations](#) (PDF)