

Acceleration load in arbitrary direction

Tutorial	
Name:	Acceleration load in arbitrary direction
Description:	Guidelines for acceleration-load application in an arbitrary direction. Applicable to static, modal, and buckling load cases.
Program:	SAP2000
Version:	14.2.3
Model ID:	na

The orientation of [acceleration load](#) may be specified for certain types of [load cases](#), including [response-spectrum](#) and [time-history](#), as shown for [SAP2000](#) in Figure 1:

SAP2000 v14.2.3 Advanced - (Untitled)

Load Case Data - Linear Modal History

Load Case Name

Set Def Name

Notes

Load Case Type
Time History
Design...

Initial Conditions
☒ Zero Initial Conditions - Start from Unstressed State
☐ Continue from State at End of Modal History

Analysis Type
☒ Linear
☐ Nonlinear

Time History Type
☒ Modal
☐ Direct Integration

Modal Load Case
Use Modes from Case
MODAL

Time History Motion Type
☒ Transient
☐ Periodic

Loads Applied

Load Type	Load Name	Function	Scale Factor	Time Factor	Arrival Time	Coord Sys	Angle
Accel	U1	RAMP	1	1	0	GLOBAL	0

☒ Show Advanced Load Parameters

Time Step Data
Number of Output Time Steps: 100
Output Time Step Size: 0.1

Other Parameters
Modal Damping: Constant at 0.05

Figure 1 - Angle specification for time-history acceleration load

For other types of load cases, including static, [modal](#), and [buckling](#), acceleration load is specified along the global axes. However, **acceleration load** may still be applied in an **arbitrary direction** using either of the following two methods:

- Establish an equivalent system by applying scale factors to acceleration loads which are oriented along global axes. For example, a resultant acceleration load 45° from the global X axis is equivalent to a UX and UY component, each scaled to 0.7071.
- Calculate and apply acceleration loads directly to the [joints](#) of a structure, done as follows:
 - Analyze the model, then display the Assembled Joint Masses table using the Display > Show Tables > Analysis Results > Joint Output > Joint Masses > Table: Assembled Joint Masses option.
 - Export this table to Excel, then, using joint [mass](#), acceleration magnitude, and acceleration direction, calculate the acceleration-load global-axes components at each joint.
 - Within a load case, apply the calculated acceleration loads using the Edit > Interactive Database Editing > Model Definition > Joint Assignments > Joint Load Assignments > Table: Joint Loads - Force option. Users may [export](#) this table to Excel, edit, then [import](#) back to the analysis software.

See Also

- **Tables** – [Interactive database editing](#)
- [Context Help](#) for acceleration-load application