

How to Find the Structure Frequency in STAAD

There are two methods: Rayleigh Method and Modal Calculation.

Below extraction applies to STADD, but it will apply similarly to other software like SFrame, RISA and SAP2000.

5.34 Frequency Calculation

Purpose

There are two methods available in STAAD for calculating the frequencies of a structure – 1) an approximate method called the Rayleigh method and 2) a more exact method which involves the solution of an eigenvalue problem.

Both methods are explained in the following sections.

Rayleigh Method

The Rayleigh frequency is based on the statically deformed shape created by solving the load case.

To get a Rayleigh frequency for a combination of two or more load cases, you must create a primary load case (not a Load Combination) using the Repeat Load command and include the Calculate Rayleigh command within the load case.

In most instances, the loads in a Rayleigh case should be in the horizontal direction in order to approximate the first bending mode. You should have one load case with Rayleigh for forces in one horizontal direction, then another load case with Rayleigh for forces in the other horizontal direction.

You should not have the MODAL CALC command in these Rayleigh cases.

Example in STAAD

*MATERIAL STEEL ALL
SUPPORTS*

1 TO 9 PINNED

*

***** Start Modal Analysis *****

*

* Define Modal Analysis mode shapes number STAAD default is 6 modes

CUT OFF MODE SHAPE 30

LOAD 1 FREQ CALC

* Define self weight in two hor directions X, Z as mass, STAAD will convert KN to kg internally

SELFWEIGHT X 1

SELFWEIGHT Z 1

* Define weight at joints as additional mass, STAAD will convert KN to kg internally

JOINT LOAD

10 TO 12 18 TO 20 26 TO 31 37 TO 39 45 TO 50 56 TO 58 64 TO 69 75 TO 77 83 -

84 TO 85 FX 222

*

10 TO 12 18 TO 20 26 TO 31 37 TO 39 45 TO 50 56 TO 58 64 TO 69 75 TO 77 83 -

84 TO 85 FZ 222

* Start to calculate frequency

MODAL CALCULATION REQUESTED

*

***** Start RAYLEIGH Method *****

*

* Get RAYLEIGH frequency in X direction, input the mass for frequency calc

LOAD 2 RAYLEIGH FREQ X

SELFWEIGHT X 1

*

JOINT LOAD

10 TO 12 18 TO 20 26 TO 31 37 TO 39 45 TO 50 56 TO 58 64 TO 69 75 TO 77 83 -

84 TO 85 FX 222

*

CALCULATE RAYLEIGH FREQUENCY

*

* Get RAYLEIGH frequency in Z direction, input the mass for frequency calc

LOAD 3 RAYLEIGH FREQ Z

SELFWEIGHT Z 1

*

JOINT LOAD

10 TO 12 18 TO 20 26 TO 31 37 TO 39 45 TO 50 56 TO 58 64 TO 69 75 TO 77 83 -

84 TO 85 FZ 222

*

CALCULATE RAYLEIGH FREQUENCY

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PERFORM ANALYSIS

FINISH

For Modal Analysis output, user has to identify a mode shape primary serving which direction based on mass participation factor, and consider this mode shape's frequency as the f_1 , f_2 , ... f_i in the corresponding direction.

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