

<https://eomys.com/produits/manatee/howtos/article/what-is-the-evs-electromagnetic-vibration-synthesis-method>



What is the EVS (Electromagnetic Vibration Synthesis) method?

- Products - MANATEE - Howtos -

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Principle

The EVS (**Electromagnetic Vibration Synthesis**) is an algorithm designed to speed up [electromagnetically-excited noise and vibration](#) calculations and get more physical insights on the [e-NVH](#) behaviour of the machine.

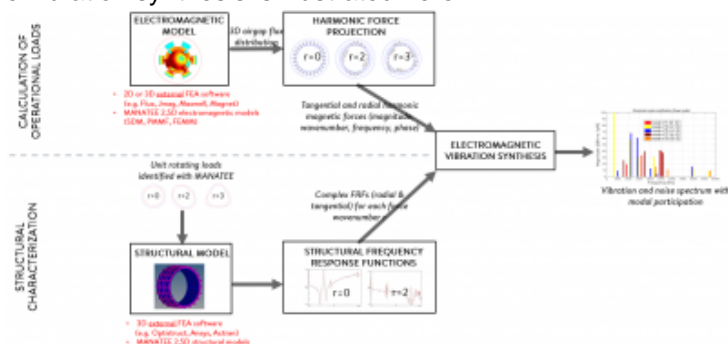
It consists in **decoupling the vibrational characterization of the electric motor structure from the operational electromagnetic excitation**, as one would do experimentally using an impact hammer or an electrodynamic shaker to measure [Frequency Response Functions](#).

As electromagnetic forces due to Maxwell stress can be decomposed in a **discrete series of rotating force waves** with specific [wavenumbers](#) which depends on slot / pole combination and winding pattern, this characterization can be carried by **artificially exciting the structure with some specific rotating force patterns** at variable frequency in radial and tangential directions. One obtains some normalized [Frequency Response Functions](#) (FRF) that can be stored for later use. This EVS method can be called the "rotating wave excitation method". Another EVS method consists in exciting each tooth of the stator with variable frequency radial, tangential and bending moment excitations. This method is called the "tooth excitation method".

Once the FRF are calculated, the electromagnetic loads are projected on the excitation basis and the vibration response is synthesized without additional calculations.

The EVS method is particularly computationally efficient at variable speed (when combined with [Spectrogram Synthesis Algorithm](#)), or during electromagnetic optimization (current shaping, pole shaping, notching).

The example of rotating wave vibration synthesis is illustrated here:



Rotating wave vibration synthesis

Application to MANATEE software

[MANATEE software](#) v1.04.06 [mechanical module](#) can apply EVS algorithm to the following structural models:

- MANATEE built-in semi-analytical vibroacoustic models (rotating wave only)
- [Altair Hypermesh/Optistruct](#) structural FEA commercial software (tooth excitation or rotating wave)
- [Ansys Mechanical](#) structural FEA commercial software (rotating wave only)
- [GetDP](#) structural FEA free software (distributed with MANATEE, rotating wave only)

What is the EVS (Electromagnetic Vibration Synthesis) method?

Coupling with other FEA software are under study.

In [MANATEE software](#) scripting mode the vibration synthesis method is chosen using the input parameter

```
Input.Simu.type_FRF
```