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MANATEE software

- Products - MANATEE -

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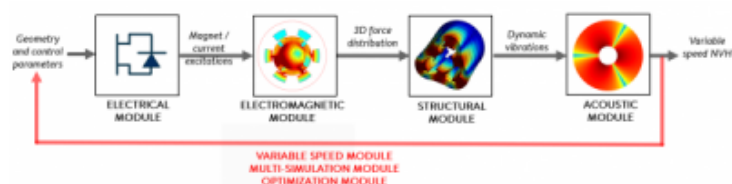
Developed and distributed by EOMYS, MANATEE (Magnetic Acoustic Noise Analysis Tool for Electrical Engineering) is the only simulation software dedicated to the **vibro-acoustic design optimization of electrical machines under electromagnetic excitations** (also called [e-NVH](#) in automotive applications).

The advantages of MANATEE® compared to multiphysic numerical software suites can be summarized as following:

1. **pre-defined multiphysic couplings** (no need to define how to couple electromagnetics, structural mechanics and acoustics) to shorten simulation set-up
2. **different levels of modelling** for use during both early electromagnetic design iterations (NVH ranking of e-machines in a few seconds of calculation up to 20 kHz) and detailed structural design (optimized coupling with structural FEA)
3. **advanced NVH troubleshooting tools** with more than 120 built-in [graphical post processing](#)
4. direct implementation of main [noise mitigation techniques](#) (e.g. skewing, notching, pole shaping, current injection, RPWM) as well as **faults and asymmetries** (e.g. eccentricities, uneven airgap, pole displacement and demagnetization)
5. numerous [industrial validation cases](#) including sound power level at variable speed, as well as [academic validation cases](#). MANATEE is regularly used in [technical publications](#) and is based on [PYLEECAN open-source project](#)
6. **no parasitic harmonics** due to remeshing, magnetic force interpolation or field projection - all harmonics can be filtered based on analytic equations

Based on powerful calculation algorithms such as [Electromagnetic Vibration Synthesis](#) and [Spectrogram Synthesis](#), acoustic noise and vibrations due to Maxwell forces can be quickly and accurately calculated both in **basic design and detailed design phase** at all the operating points of the e-machine.

A unique combination of electrical engineering and vibro-acoustic know-how allows to understand the [root cause of Noise Vibration Harshness](#), and implement several [acoustic noise mitigation techniques](#) during the electromagnetic and structural design of electric motors. MANATEE can be used **after manufacturing** as a **fault diagnosis tool** of noisy electrical machines.



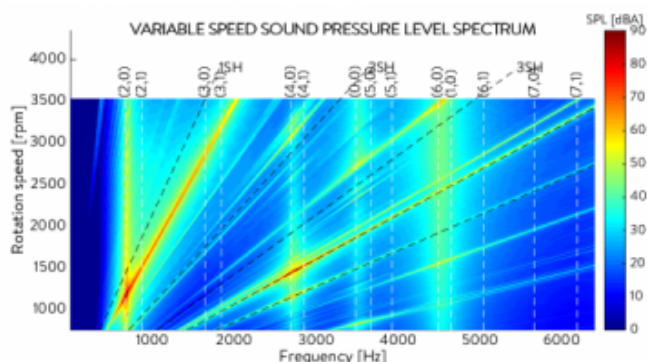
MANATEE NVH simulation workflow

These features make MANATEE a must-have tool for electrical machine designers who need to **include the NVH criterion at design stage**, but also an electromagnetic design software that is more open, flexible and cost competitive than other software solutions. The [coupling of MANATEE with FEMM](#) allows efficient hybridation of numerical and [semi-analytical magnetic models](#) for the fast and accurate assessment of electromagnetic excitations.

MANATEE also includes **optimization and parameter sweep modules** to help finding **the optimal trade-off**

between electromagnetic and vibro-acoustic performances of an electrical machine, avoiding extra costs (e.g. change of rotor, rewinding of stator, use of acoustic insulation or vibration dampers) when sound or vibration level is unexpectedly high after manufacturing.

MANATEE unique algorithms gives the acoustic pressure and power level up to 20 kHz at variable speed within a few seconds of calculation:



Variable speed sound pressure level spectrum

Contrary to a finite-element-based multiphysic simulation chain, MANATEE can be used during **early electromagnetic design optimization loops** (e.g. optimization of the slot and pole number combination, optimization of the magnet shape), and captures the electric motor NVH behaviour over the **full operational range** ([noise maps](#)) within a reasonable time. Electromagnetic, structural and acoustic models are seamlessly coupled.

A general presentation of MANATEE software is available here:



MANATEE NVH simulation software of e-motors

MANATEE includes more than 150 plot commands giving **physical insights in simulation results** (e.g. FFTs, operational deflection shape, order tracking, analytical harmonic expressions). They are accessible in command line and are detailed in [Plot commands](#) part.

An online help is available as short questions and answers in the [HowTos](#) part. They cover all functionalities of MANATEE.

Some more advanced tutorials covering the full simulation process from electromagnetics to vibroacoustics on different machine topologies can be found in the [Tutorials](#) section.

All the electrical, electromagnetic, mechanical and acoustic validations of MANATEE can be found in the [Validations](#) part.

Licensing information can be found in part [License](#).

Other documentation (e.g. installation guide) on MANATEE is available in [Resources](#) part.

For an official quotation request, you can contact us through the [contact form](#).

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