Supplementary material for the paper:

Minimal requirements for the vibration-based identification of the axial force, the bending stiffness and the flexural boundary conditions in cables

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As indicated in the paper, the question on how to corrupt the mode shapes has no consensual answer and adding independant Gaussian noises without taking any spatial correlation into account is by no means realistic and appropriate. The current practice in modal identification is to have recourse to *mode smoothing*. In particular, this means that, if experimental data had to be processed, the mode shapes would be assumed to be correctly approximated by their asymptotic expression, see Eq. (31), and the constant C that provides the best fit with measured modal displacements would be computed. This is a smart way of applying mode smoothing: projection into a subspace which makes sense from a theoretical point of view. Please notice that this is just one possibility among many; other authors would use a finite element model updating framework, others would probably simply low-pass filter the mode shapes while constraining the displacements at the cable ends.

It seems that a suitable manner to corrupt modes is then to slightly modify this constant C. By doing so, it is supposed that the effect of uncertainties that are correlated in space can in fact be simulated. Figure 1 in this document shows the objective functions which include modal displacements only. Blue-to-green curves refer to a case where C is exact while it is corrupted by a Gaussian noise of 3% intensity for red-to-yellow curves. The mode shapes do not depend at all on Ω_c and the objective function is almost flat with respect to ε. Hence, the identification procedure does not appear to be influenced by the modal displacements in the 2-D space represented on the right graph. The reason is that mode smoothing has been used as any user would do, to some extent. Besides, on the left graph, the objective function is also almost not affected by the noise that have been added on the constant C.

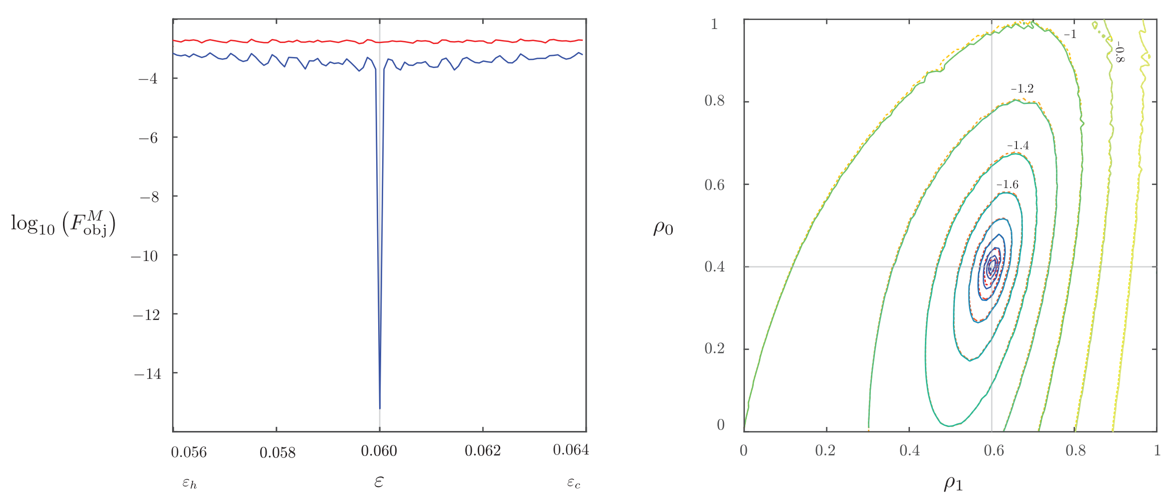

Figure 1: Contours of the objective function in log-scale around a given set of target parameters, $\mathbf{x} = \{5 \text{ rad/s}, 0.06, 0.4, 0.6\}$, when $k_\omega = \emptyset$, $k_\phi = \{1-3\}$ and $\xi = \{1,2,4\}\,\varepsilon/2 \cup 1 - \{4,2,1\}\,\varepsilon/2$. Blue-to-green plain lines and red-to-yellow dashed lines correspond respectively to different noise intensities, $I_n = 0\%$ and $I_n = 3\%$. Contours are spaced by a 0.2 difference in the decimal logarithm of the objective function.

NOTE: these results have been collected and formatted to answer a question from a reviewer, who is especially thanked for the valuable discussions his/her comments generated. The reader can find more information about this file and the associated paper on the institutional repository of the authors, by copy-pasting this link https://orbi.uliege.be/handle/2268/259288 in a web browser.