# Conception d'un détecteur de système mécatronique mobile intelligent pour observer des molécules en phase gazeuse en IR.


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**Abstract**


This work anticipates that, in an ever-expanding digital technology world, technological breakthroughs in the analysis of data collected by spectroscopic devices will allow the almost instantaneous identification of known species observed in-situ in a specific environment, leaving the necessary in-depth analysis of unobserved species. The method derived from RBDO (Reliability Based Design Optimization) technology will be used to implement an artificial intelligence procedure to identify observed species from a mobile IR sensor. To successfully analyze the obtained data, it is necessary to appropriately assign molecular species from the observed IR data using appropriate theoretical models. This work focuses on the observation from mobile devices equipped with appropriate sensors, antennas, and electronics to capture and send raw or analyzed data from an interesting IR spectroscopic environment. It is therefore interesting if not essential to focus on symmetry-based theoretical tools for the spectroscopic analysis of molecules, which allows to identify the IR windows to be chosen for observation in the design of the device. Then, by fitting the theoretical spectroscopic parameters to the observed frequencies, the spectrum of a molecular species can be reconstructed. A deconvolution of the observed spectra is necessary before the analysis in terms of intensity, width and line center characterizing a line shape. Therefore, an adequate strategy is needed in the design to include data analysis during the observation phase, which can benefit from an artificial intelligence algorithm to account for differences in the IR spectral signature In this regard, the analytical power of the instrument data can be improved by using the reliability-based design optimization (RBDO) methodology. Based on the multi-physics behavior of uncertainty propagation in the hierarchical system tree, RBDO uses probabilistic modeling to analyze the deviation from the desired output as feedback parameters to optimize the design in the first place. The goal of this thesis is to address IR observation window parameters to address reliability issues beyond mechatronic design to include species identification through analysis of collected data.