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Digital algorithm for sound synthesis : realism and complexity for creativity

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Modalys, a sound synthesis software developed at Ircam for research and musical applications, make it possible to build virtual instruments based on physical models in order to obtain the broadest range of expressive variations in the instrument in response to intuitive controls. An instrument, as a complex structure, is described by the mechanical/acoustical interactions of its components (strings, tubes, soundboard, 3D FEM objects...). New researche has recently carried out in two directions:

On one hand, a generic digital algorithm able to treat a large class of non linear interaction models (lip-reed, contact and friction, aero-acoustics jets, etc) was built. Based on a Gauss-Siedel strategy, this algorithm is used indifferently regardless of the modeled structure's complexity and guaranties convergence and robustness of the whole sound synthesis.

On the other hand, efforts are made to infer from measurements the physical parameters needed for the sound synthesis (geometric or gesture parameters for example). Due to the lack of a complete analytical formulation (digital algorithm), derivative based methods to solve inverse problem (Newton, gradient, etc) are not allowed. Evolution Strategy (ES), especially for multiobjective optimization, are then investigated.