

## A NEW ENGINEERING ENVIRONMENT ADAPTED TO PRELIMINARY DESIGN IN INDUSTRY

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**Abstract:** We present a new platform dedicated to preliminary design. This platform allows to size manufacturing products. This environment is based on a separation of concern between the physical model development, the industrial and manufacturing constraints and objectives choices and the algorithmic resolution methods. These three concerns reveal three type of users. The first user, the research engineer, is in charge of developing, testing and validating physico-economical models in form of set of mathematical equations. In our platform, this does not require any programming skills. The transformation of the mathematical model into a code usable by the platform is done using grammars and code compilation concepts. Nonetheless advanced mathematical concepts such as complex numbers, integration, derivation, differential system resolution, implicit systems and even regression are supported by the environment. The role of the second user, the designer, is to define the constraints on the model. This role is the one that requires the less expertise as it usually consists in adapting external specifications. The software presents the designer with a view of the model's parameters (without the underlying equations) for him to choose optimization variables, constants and constraints in addition to the objective function. The platform provides information on the optimization process that can be helpful in case it fails, to adjust specifications accordingly. The third user, the numerician, defines if needed optimization methods. The platform allows, through the use of a public API, the integration of implementations of (possibly new) optimization methods that will then be available transparently in the platform. The optimisation problem created by the environment provides an exact gradient that is analytically computed, allowing the efficient use of derivation based algorithms. The software provides additional functionalities commonly required in the industry: interoperability with already existing environments such as Matlab/SciLab, Excel. We also provide the access to models through black-boxes as well as the use of black-boxes inside a model. An actual electrical engineering product's design with our software will be developed extensively in the full paper.