



White Paper - Agile Mixture Design

Many industrial (re)search problems are very constrained and extremely difficult to solve in constant time. Mixture design problems are a prominent example and include, among many others, industrial gas mixtures, beverages, batteries, biotech, construction materials (concrete, asphalt), new AM materials (alloys, plastics), infotech. In mixture design problems, each additional mixture component makes it more difficult to work with well distributed mixture designs.

Existing market solutions provide classical mixture DoE functionality, where the distribution of mixture designs is usually derived from k-simplex centroid plots and compressed into a mathematical model. There are at least three problems with this common approach: (1) the amount of necessary trials grows exponentially with the amount of mixture components; (2) with each new mixture component it becomes more complicated to keep mixture designs well distributed and manageable; (3) mathematical model is only as good as the data points derived from k-simplex plots.

We at Exponential Technologies Ltd. have developed a system that uses advanced AI methods for solving mixture type DoE problems. In particular, the system helps organize and carry out R&D experiments more efficiently. Our system easily learns, operates and produces well distributed mixture designs, no matter the amount of mixture components. As a result, it helps R&D teams find optimal mixture designs in about 5 series of 20 trials each, where a single trial refers to a single tested mixture design.

Our system is mixture problem agnostic, extremely fast and thus compatible with any relevant R&D facility. For example, currently the system is being used in concrete design improvement, but it can also contribute to the development of new printable alloys for specific SLM machines or other use cases. Thus, our system enables rapid material innovation, allowing our customers to have faster go-to-market times with their innovative products and to reduce overall R&D costs.

The system also supports research management functionality and process parameter development. Our system is available as an online cloud solution **xT smart_DoE** and as an offline on-premises solution **xT edge**. Mixture designs, developed using our system, are safe and secure. In case of an online solution, customers can easily obfuscate their experiments, while in the case of an offline solution, customer data never leaves the premises.

To find out more, visit our website www.x-t.ai or write us an email to info@x-t.ai.