From programs to gradients

\[ \overleftarrow{f} : f \mapsto \nabla f \]
From programs to gradients

\[ \mathcal{J} : f \mapsto \nabla f \]

From gradients to optimization

\[ \text{argmax } f \triangleq \text{fixpoint of } \{ x_{i+1} = x_i - (\nabla \nabla f(x_i))^{-1} \nabla f(x_i) \} \]
From programs to gradients

\[ \mathcal{F} : f \mapsto \nabla f \]

From gradients to optimization

argmax \( f \triangleq \text{fixpoint of } \{ x_{i+1} = x_i - (\nabla \nabla f(x_i))^{-1} \nabla f(x_i) \} \)

From optimization to a science of design

\begin{align*}
\text{performance } &\triangleq \text{SplineControlPoints} \\
\text{let } &\triangleq \text{SplineToSurface SplineControlPoints} \\
&\text{airflow} \triangleq \text{PDEsolver (wing, NavierStokes)} \\
&\text{lift, drag} \triangleq \text{SurfaceIntegral (wing, airflow, force)} \\
\text{in DesignMetric (lift, drag, (weight wing))} \\
\end{align*}

argmax performance