

## **122f Transport Insights**

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Transport phenomena has been a staple of our curriculum for nearly half a century now, and many, Eli Ruckenstein among them, have found many ways to make this discipline useful to engineers. Examples of interest to this talk include dimensional analysis and asymptotic solutions of the truncated equations. However, at the beginning of the design process there is still a need for heuristics, and there is the basis of this talk. Buried in even the most familiar topics are hints that can be invaluable during preliminary design, useful guides that tend to be ignored by those too impressed by frequent over-emphasis on scientific rigor. This point of view has been expressed by such outstanding theoreticians as Henri Poincaré who once wrote "whereas it is by logic we prove it is by intuition that we invent. Examples provided here will show that even the ubiquitous Fanning friction factor graphs, dating almost to the origin of our profession, can yield useful insight in such unexpected directions as scale-up of in line mixing and even the prediction of flying or swimming motions of insects, birds and fish. It will also be shown how one can solve one pressing problem of distributing heat through a large piping network to outlying users or choosing a packing type for diffusion and reaction. Other examples include the modeling of biological enzyme complexes. In each case one must of course examine tentative solutions carefully before adopting them - but the chief design problem is identifying them in the first place.