



The Myth of Accuracy

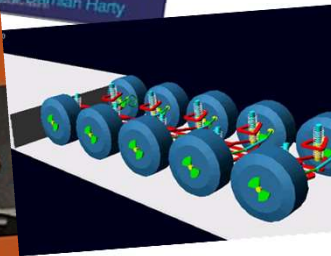
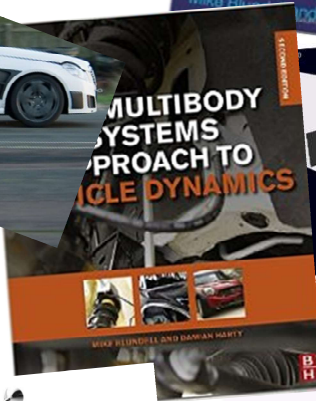
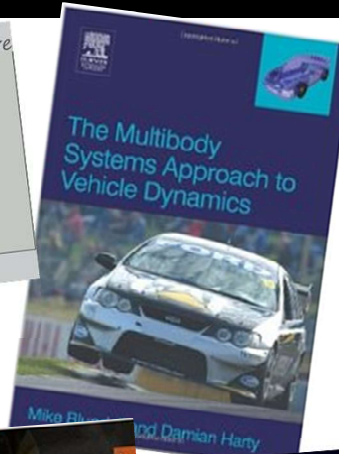
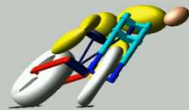
“All models are wrong, some models are useful” (George Box)

Damian Harty

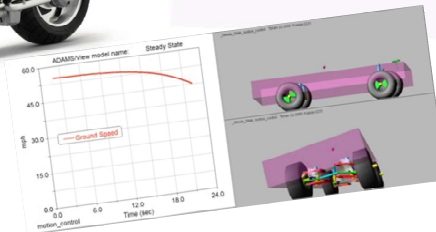
A Rich History of Modelling and Discovery through Modelling



closed loop control of front wheel lift using drive



- Published author in multibody modelling
- Commercial and classical methods, tools
- Motorcycle stability, handling and durability modelling tool generation
- Limit/Post-Limit control modelling
- World Rally Car damper & steering research
- Conclusions sometimes counter “prevailing wisdom”
- Passion for true all-circumstance autonomous control

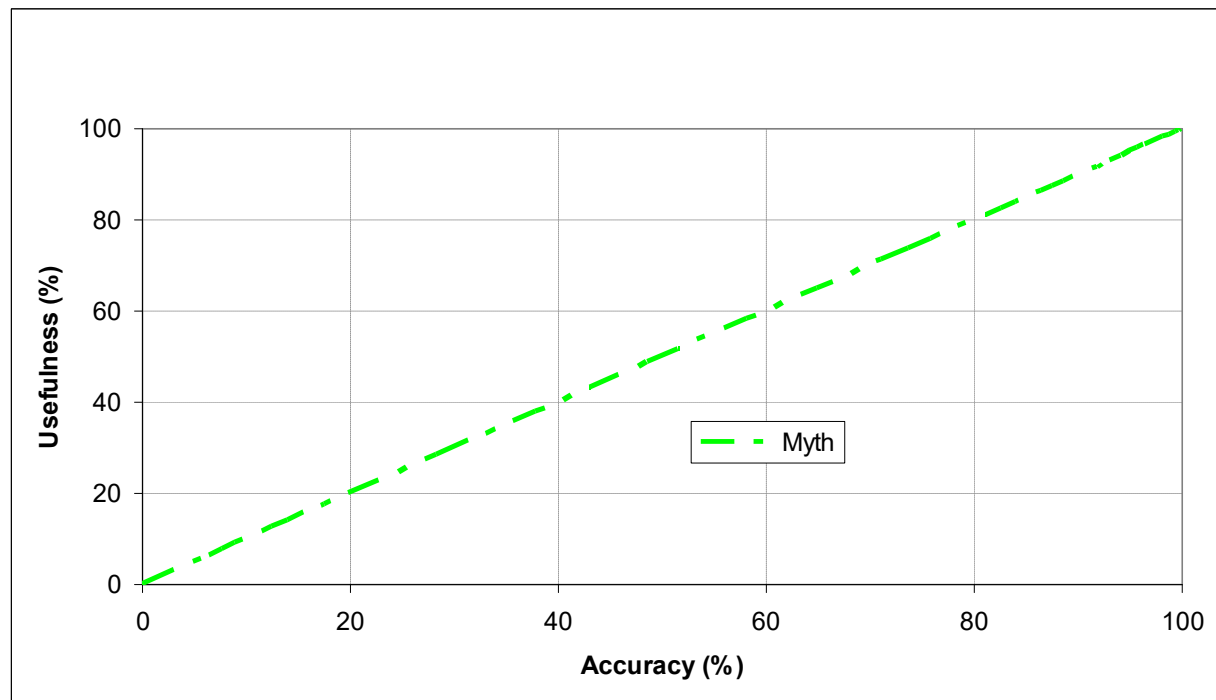


The Myth of Accuracy

- It's easy to believe that the “usefulness” (utility?) of any modelling process is directly related to its accuracy

$$\textit{Use} = \textit{Accuracy}$$

- This simple misconception can cost money for organisations
- Reality is not complex but rather somewhat counter-intuitive!



The Myth of Accuracy

- What is Accuracy?
- *“the absence of a numerical difference between predicted and measured behaviour”*
- not yes/no; absence of accuracy = error
- is the measured data what actually happens in the absence of measurement?
- is the measured data what actually happens in service?



Tay Bridge collapse, 1849.

Costing 75 lives, the collapse was subsequently attributed to the absence of cross-wind loads in design calculations.

The Myth of Accuracy

- What is Usefulness?
- *“the degree to which predictions are able to be used advantageously in the design process”*
- if predictions are not to be used during the design process their merit should be questioned
- if predictions are not timely, they are not useful – however good they are



Boeing Dash-80, the prototype 707 airliner, first flew in 1954.

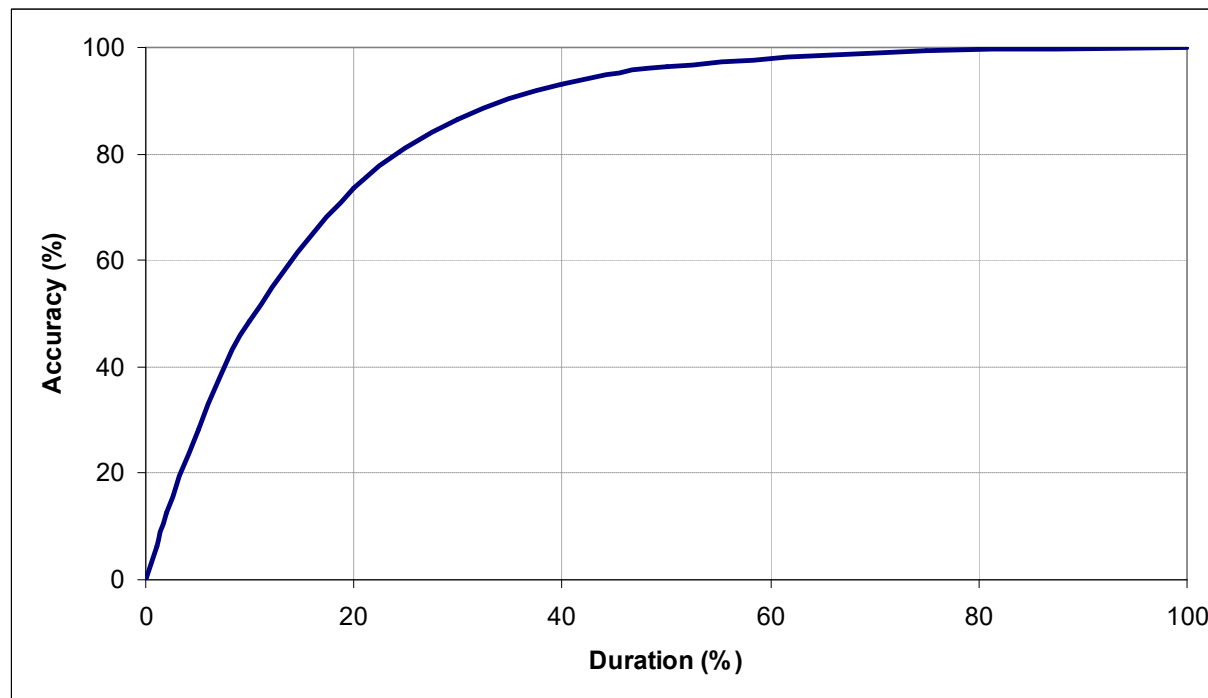
It famously performed a roll at the 1955 Seafair Gold Cup. Boeing President William Allen asked a guest with a heart problem to donate some pills, having not been told about the planned stunt beforehand. Orders rolled in and the rest is history.



The Myth of Accuracy

- How does accuracy relate to usefulness?
- Consider the “law of diminishing returns”, which could be represented thus:

$$Accuracy = 1 - e^{-duration}$$

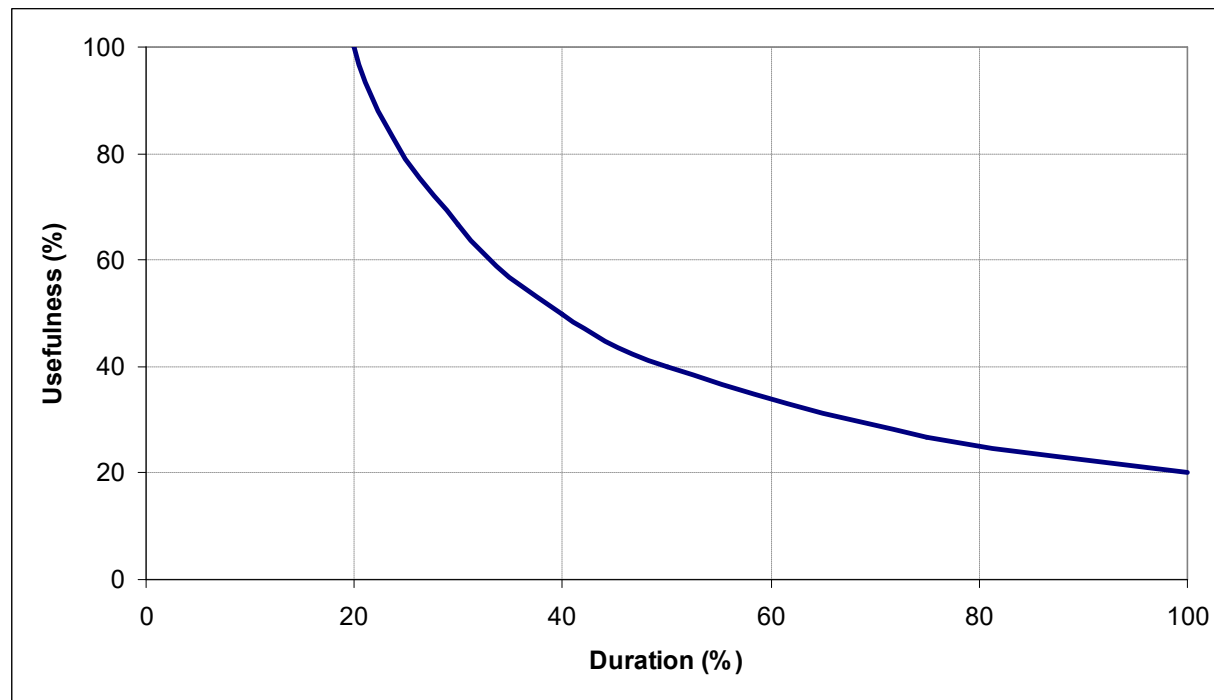


The Myth of Accuracy

- It could be argued that Usefulness is degraded by excessive duration:

$$Use = f\left(\frac{1}{duration}\right)$$

- (the same answer known sooner is more useful)

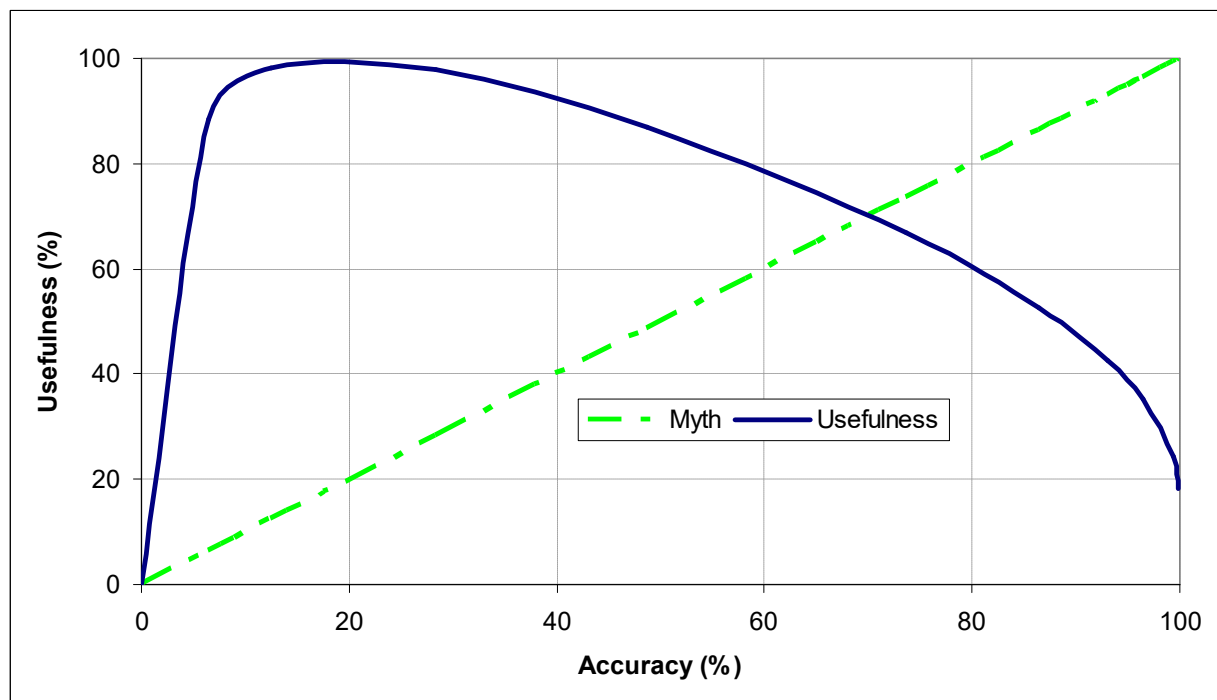


The Myth of Accuracy

- Clearly the accuracy of the answer is of some import
- Combining this with the previous description yields:

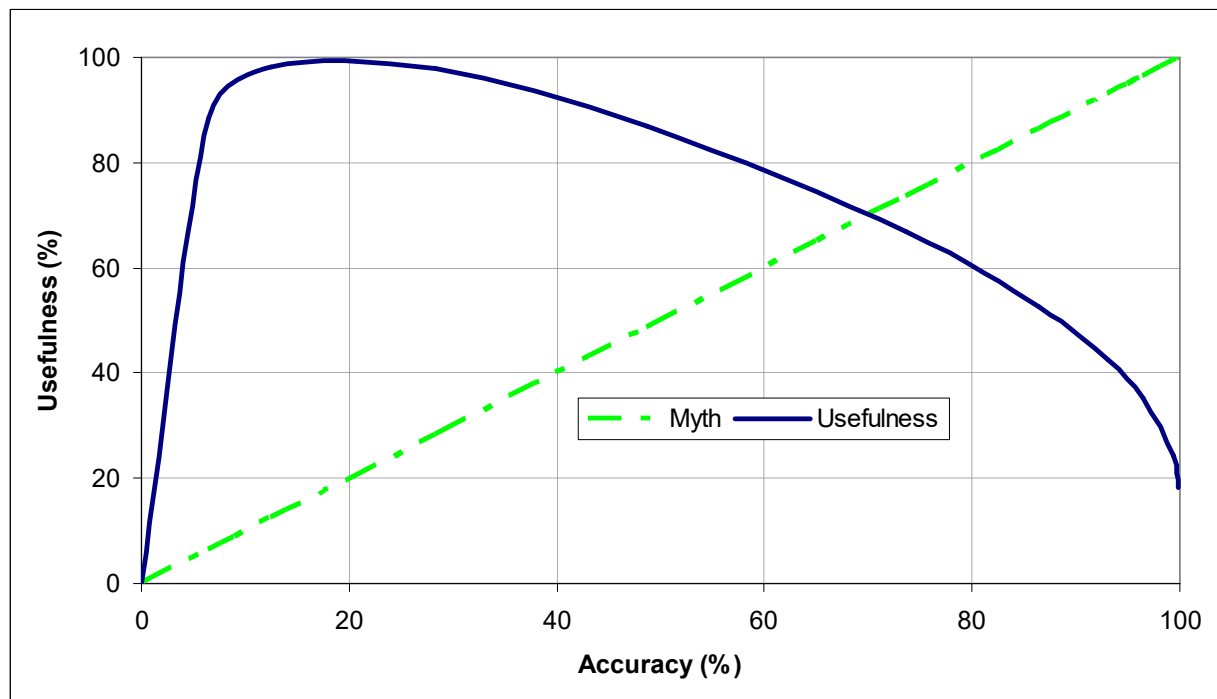
$$Use = \frac{Accuracy}{-e^{(1-Accuracy)}}$$

- Compare it with the myth:



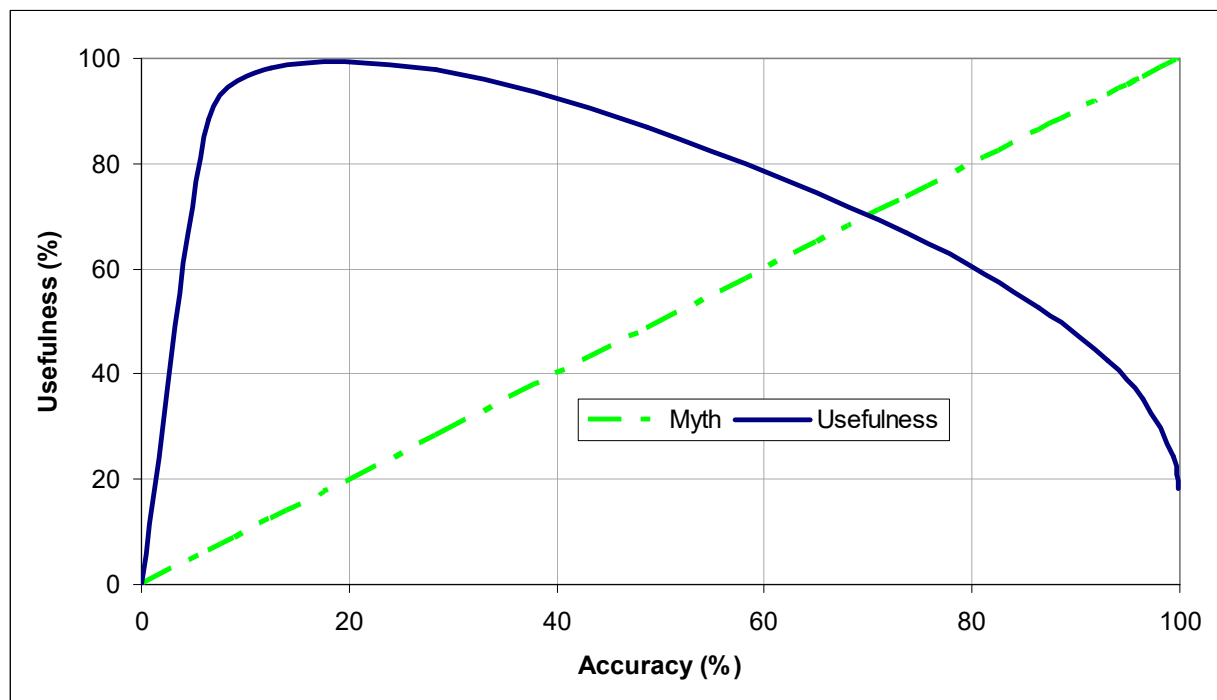
The Myth of Accuracy

- Am I advocating 80% error in all calculations?
- Er, no
- Some level of accuracy is necessary to discern the consequences of the decisions being made; if the method cannot distinguish between alternatives it is inapplicable
- Downward convex curve suggests *unnecessary* accuracy should be studiously avoided
- Beware the paralysis of analysis!



The Myth of Accuracy

- “The most cost effective analysis activity is accurately recalling and comprehending what has gone before”^[1]
- “All models are wrong, some models are useful” (George Box)
- “Simple models, smartly used”
- If I add this to the analysis, what decisions will it change once the results are known?



[1] “The Multibody Systems Approach to Vehicle Dynamics”, Blundell & Harty, 2004, Elsevier Science