

Comment

A remark to the paper by O. N. Kirillov and F. Verhulst “Paradoxes of dissipation-induced destabilization or who opened Whitney’s umbrella?”

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We read the paper and found quite interesting to bring attention of the applied mathematical and mechanical society to the early work by Oene Bottema (1956). It is also a good idea to give a review of dissipation-induced destabilization phenomena in a single paper. However, we have an important remark.

The paper by Oene Bottema is a remarkable study of a two-degree-of-freedom system in terms of 4th order polynomial coefficients. Revealing the generic nature of Ziegler’s paradox in multiple ($n > 2$) degrees-of-freedom systems requires methods of singularity theory developed much later in 70s by V.I. Arnold and others. In 1999 we published an important paper dedicated to Arnold’s 60th anniversary devoted to the analysis of generic singularities on stability boundaries, see [1]. In this paper, we associated Ziegler’s paradox with a specific configuration of generic singularities in three-parameter space (an edge and “deadlock of an edge”, which is a half of Whitney’s umbrella). As shown in our paper, qualitative properties of the stability boundary underlying the paradox can be described by addressing the list of generic singularities given by Arnold in 1972. This result provided a final step in the qualitative understanding of Ziegler’s paradox as a singularity. Without this understanding, the study of Oene Bottema (1956) would remain a study of the singularity in a simple specific case. This study with the reference to our paper in SIAM appeared in our book [2]. It is surprising that neither our paper nor our book are mentioned in the Introduction of the paper by Kirillov and Verhulst. The book [2] is mentioned in other sections of their paper but in different context.

It is nice to revisit the nearly forgotten result by Oene Bottema (1956) and ‘reopen Whitney’s umbrella’ but it is also necessary to remember more recent results published in [1, 2].

References

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