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Prof. Benoit Bergeon  
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Dear Prof. Bergeon:

The paper "On Bode's 'Ideal Cut-off Characteristics' and Non-rational Feedback Laws" with Reference Number 05-471, that you submitted for possible publication in the *IEEE Transactions on Automatic Control*, has been evaluated by an Associate Editor. I am sorry to inform you that, based on the Associate Editor's report with which I concur, we have decided not to solicit outside reviews and not to consider the paper any further for publication. The main reasons for this decision are explained in the enclosed Associate Editor's report.

Thank you for your submission to the *IEEE Transactions on Automatic Control*. We welcome all future papers that you may wish to have considered for publication.

Sincerely,

Christos G. Cassandras  
Editor-in-Chief

c: AE  
Ref. No.: 05-471  
Title: On Bode's "Ideal Cut-off Characteristics" and Non-rational Feedback Laws  
Authors: B. Bergeon

## Review of "On Bode's "Ideal cut-off characteristics" and non-rational feedback laws" 05-471

### Pre-amble

This paper was originally submitted as a Technical Note with ref. # TN05-02-04 which was rejected. The review comments were summarized by the AE as follows

- AE.s.a Realization of the ideal loop transfer function over the entire frequency axis is undesirable, e.g. it typically leads to a controller with infinite gain at high frequencies. This is pointed out in the paper, but has also been noted earlier in the literature, starting with the work of Bode, cf. R#1.a, R#2.c, R#3.b and AE.c.
- AE.s.b In certain applications, such as the mechanical examples provided in the paper, the problem of attempting this manifests itself as unstable pole cancellations.
- AE.s.c Single minded application of this objective, even by limiting the frequency interval over which the approximation takes place, does not guarantee that other important objectives, such as good input load rejection, are met. This is clearly illustrated in the paper. However, as pointed out by Referee #2 (R#2.b) it is generally acknowledged that control design includes many objectives.
- AE.s.d The problems described above are not specifically connected to the non-fractional nature of the control associated with the ideal loop transfer function, cf R#2.d.
- AE.s.e It is clear that there are published papers in which the problems pointed out in the paper have been neglected. However, for the car suspension example, recent work (by the same authors) takes these issues into account, cf [Moreau et al, 2004] cited by R#3. This points to that the awareness of the limitations of designs based on the ideal loop transfer function has increased in recent years.
- AE.s.f The claim in Section 4, that also approximations of the ideal loop transfer function will lead to poor performance seems unfounded, cf AE.b.

Furthermore, the AE concluded

*The paper points out some important pit-falls related to Bode's ideal cut-off characteristics and points to published examples where these have been neglected. Thus, the AE agrees with R#1 that the points made are essentially correct. However, the contribution does not seem to be completely at the point in that the real issues do not come out very clearly, cf AE.s.d, and the review of previous work is not satisfactory.*

*The main issue regarding if the paper may ultimately become publishable is the novelty of the points made in the paper. In this respect, the limitations of the approach have been pointed out by veterans in the field such as Bode, Horowitz and Astrom. Although seemingly rather recently, these issues have also been picked up in CRONE control, a control methodology close in spirit to Bode's ideas on the ideal cut-off characteristics and the methodology employed in one of the examples in the paper. Furthermore, it must be considered well-known that designs based on unstable pole cancellations are inappropriate.*



*It is more unclear if, e.g., the specific transfer function from open loop system input to output (input load disturbance) has been considered previously in this context. To conclude, there is some novel material but still quite limited.*

*Based on these observations, the AE does not find that the contribution is significant enough to warrant publication as a Technical Note in the IEEE Transactions on Automatic Control.*

#### **Revision**

The main novelties in the revised manuscript are

1. One of the examples have been cancelled.
2. The controllers have been made proper by the introduction of a low pass filter.
3. The introduction has been modified to point out that Bode's objective was to approximate the "ideal cut-off" in a small frequency range.

#### **Comments by referee**

C1 Despite that the introduction has been modified so that it indicates that the "ideal cut-off" only should be approximated over a limited frequency range, the discussion in the ensuing sections disregards this. The controller is made proper by low pass filtering but the low frequency part is not modified and examples where pole/zero cancellations occur at zero frequency are used as illustrations, c.f. with AE's comment AE.s.a. This should be compared with the paper by Åström that is cited. In Section 2.6 in Åström's paper a controller which approximates the ideal controller around the cross-over frequency is given in Equation 19.

C2 As the AE has acknowledged, the control design in the suspension example does seem flawed. However, more recent work by the same authors only tries to approximate the ideal-cut off over a limited frequency range. Whether these designs still suffer from other problems seems to be beside the point in the context of the paper under review where the use of the "ideal cut-off" as design tool is under focus.

#### **Review summary**

The revision has been minor and the main conclusions made by the AE on the original paper still remain valid. Following, the AE's original decision I therefore recommend that the paper is rejected.