

# Generalized Tellegen's Theorem and Its Applications in System Theory

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## Abstract

The paper deals with application of Tellegen's theorem for systems modeling and solutions. The proposed approach is based on generalization of Tellegen's theorem well known from electrical engineering. The novelty of this approach is that it is based on the abstract state space energy for real linear, nonlinear and chaotic systems. The main aim of the contribution is to formulate a fundamental problem of physical correctness detection of system representations and the sequel proposes is possible. It was derived that for system described by special structure and appropriate mathematic equations the generalized Tellegen's theorem is given as scalar product of vector of state space variables and its derivation. Mathematically as well as physically correct results are obtained. Some known and often used system representation structures are discussed from the abstract state space energy point of view. Most important is, that time evolution of energy can be used for classification of systems, e.g. periodic, non periodic, chaotic. The examples of linear, nonlinear and chaotic systems are also included.

## References

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