Sustainability and time horizon

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Abstract: In the case of theoretical studies for the sustainable development, one approach is building a dynamical system to study the problem at hand, and solve the problem by finding a balance or stable area, usually noted attractor. When dynamical models are differential equations, sustainability is often linked with asymptotic properties, and so with bifurcation diagrams. This can be justified by the fact that sustainability urges to think of the needs of future generations. Nevertheless, not being stuck to present time does not mean only considering asymptotic properties and consequently infinite horizon. Two reasons can be suggested: models are not indefinitely valid, and sustainability should not mean forgetting present generations. The time factor is not taken into account in asymptotic studies, although transient dynamic can be prominent for the validity span of the model. For example, in the figure 1, these two trajectories tend to the attractor, but the dotted one remains a relatively long time very close to 0. Therefore, we need to find ways to solve these problems.

The viability theory initiated in the early 1990s by Jean-Pierre Aubin [1] and his colleagues focuses on the problem of viability, it concerns controlled dynamical systems for maintain a dynamic system in a set of constraints. This theory appears in economics, cognitive science, game theory, biology, automatic, etc. Thanks to viability theory, we can find a domain that all the point in this domain will remain in constraints infinite time. This is fully consistent with the premise of sustainable development.

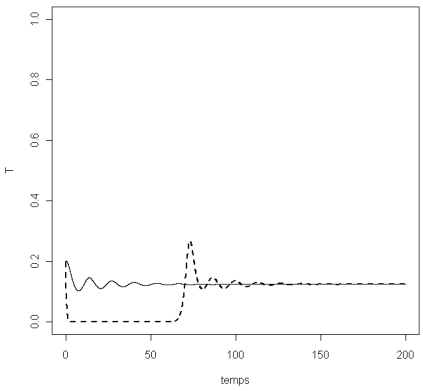

Figure 1.

References:

[1] J.P. Aubin (1991). *Viability theory.* Birkhäuser.

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