Using a Small Model of Technical Systems in Systems' Improvement

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(short information on the proposed presentation)

The laws of Statics, introduced by Altshuller [1], request the following conditions must be met for a technical system to fulfil its main useful function fully:

- The system must contain at least four main elements: the supply, the transmission, the instrument and the controller.
- Each main element of the system needs to be at least minimally able to fulfil its function within the system, assuring that the main useful function of the entire system can be delivered.
- At least one of the system's main elements needs to be controllable in order for the whole system to be controllable.

Moreover, to perform well, the system must have unobstructed flow of matter/energy/information from the supply to the instrument.

The proposed small model of a technical system depicted in Figure 1 is based on the discussed laws of Statics. It consists of six elements. The technical system is represented by the supply, the transmission, the instrument and the controller. The flow of matter/energy/information from the supply to the instrument is pictured by the "*Interaction*" arrows. The controller managers the other three main elements by adjusting the flow of information/matter/power. The system's environment is represented by two elements: one interacting with the supply and another one interacting with the instrument. The influence of the environment onto the system can also happen via the controller (the "*Input*" arrow).

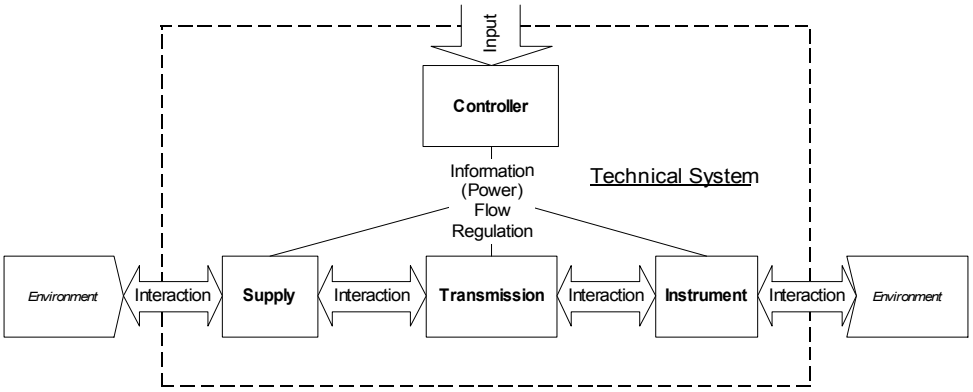

Figure 1. Small model of a technical system

Such system representation permits to analyse the flow of matter/energy/information from the supply to the instrument and to identify the most problematic interactions between the system elements. To achieve this, a user needs to create the Matching Table of every interaction, presented in Figure 2.

INTERACTION	Element A	Element B	Match
Time			
Space			
Dimensions			
Dynamics			
Structure			
Phys.-chem. char.			
Energy			

Figure 2. The Matching Table

The Element A and the Element B in the Matching Table in Figure 2 correspond to the interacting elements of the small system model depicted in Figure 1.

This model can also be expanded hierarchically. for every element of the original mode as presented in Figure 3. This assures that any technical system can be considered as a subsystem of a bigger system. Also it assures that any separate element of the system can be focused at on its elements on the subsystems level.

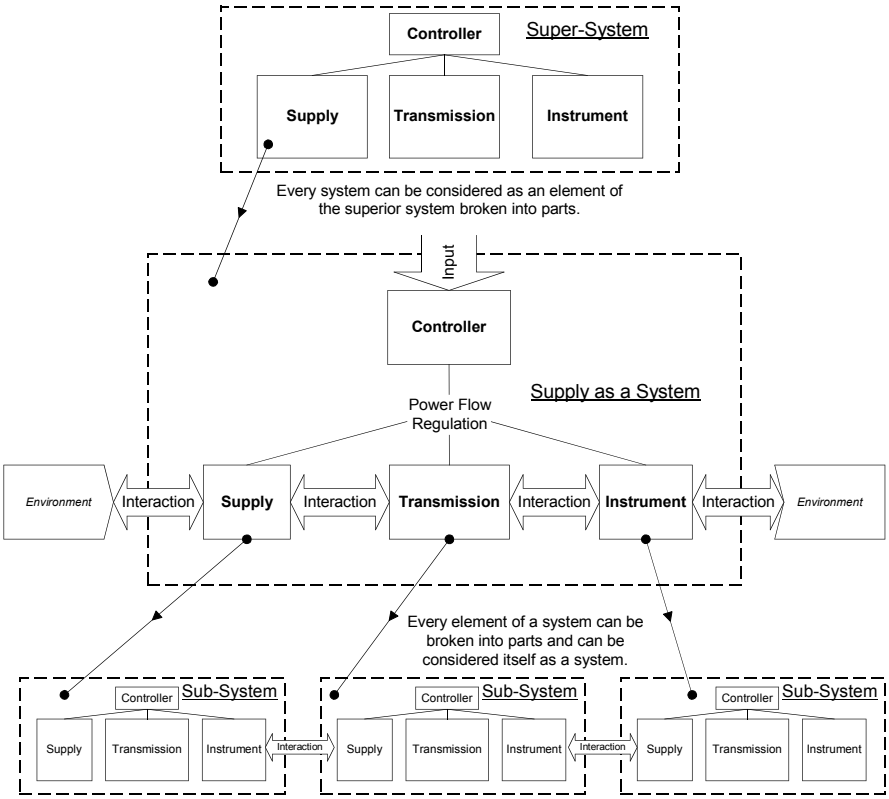

Figure 3. Hierarchy of a Small Model

Expanding the model onto various hierarchy levels and analysing elements' matching makes it possible to directly focus onto the system's conflict zones. This helps to identify the direction for the most effective improvement.

The model has been successfully used in six projects (real company tasks). Some of the successes will be discussed. The following is the example of usage of the proposed model for improvement of a gas cooktop (project completed in 2004).

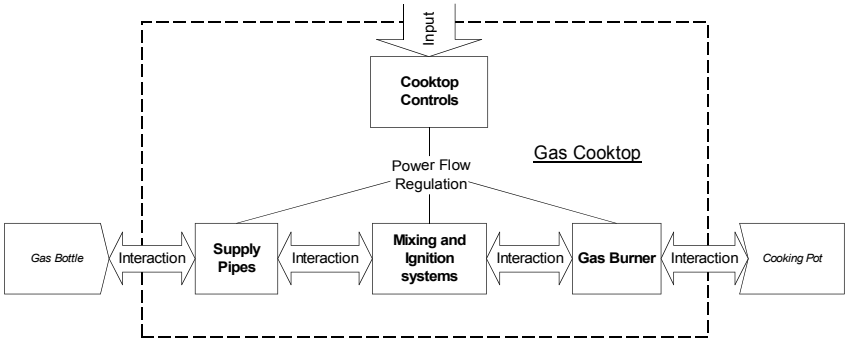

Figure 4. A Small Model of a gas cooktop.

The following is the Matching Table for the interaction of the Gas Burner and the Cooking Pot. It has identified two areas of a mismatch between the two elements: the dynamics and the aggregate state.

INTERACTION	Gas Burner	Cooking Pot	Match
Time	Adjustable	Adjustable	Medium
Space	P/Adjustable	Fixed	Medium
Dimensions	3D	2D	Medium
Dynamics	High	Low	Low
Structure	Mac/Mic/Field	Macro	Med/Low
Aggregate state	Solid/Gas	Solid	Low
Energy	Thermal	Thermal	High

Figure 5. Gas burner – Cooking pot Matching Table

Figure 6 depicts the Matching Table for the instrument of the Gas Burner (lower level of hierarchy) – the Flame and the supply of the Cooking Pot – the Bottom of the Pot.

INTERACTION	Flame	Bottom of a Pot	Match
Time	Adjustable	Adjustable	Medium
Space	Adjustable	Fixed	Medium
Dimensions	3D	2D	Medium
Dynamics	High	Low	Low
Structure	Micro/field	Macro	Low
Aggregate state	Gas	Solid	Low
Energy	Thermal	Thermal	High

Figure 6. Flame – Bottom of the pot Matching Table

The mismatching is clear, so as the directions for the improvement.