

# Applications of Control Principles to International Relations

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Although control principles are not customarily associated with international relations, there may be some significant advantages in seeing how international relations may benefit by suitable use of control con-

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cepts and methods. Over the years, control engineers and scientists have learned how to use information processing and equipment, along with energy and materials to improve the performance of various systems. Providing improved control has significantly increased performance of widely varying systems, such as those for industrial manufacturing, for electrical utility power generation, and for high-speed transportation and communication. It may be feasible to find the information and control means that will improve international stability and reduce the likelihood of war.

During the learning process of developing new and improved control systems, the overriding needs have been to provide stable system operation and to steer the system onto desirable paths and trajectories. These same needs apply to international relations.

For about five years, there have been modest efforts taking place under the title of Supplemental Ways for Improving International Stability (SWIIS). These efforts have been directed toward using control principles, such as adaptive control, predictive control, learning systems, expert systems, systems modeling, and other state-of-the-art techniques to try to see how the likelihood of major wars between the superpowers could be reduced. A SWIIS Working Group, under the International Federation of Automatic Control (IFAC), has also been promoting these efforts.

### Closed-Loop Principles

The closed-loop principles involve (1) providing a reference signal to a process, (2) comparing that reference with the performance of the process, and (3) using that difference to provide a basis for control of the decision-making process. These principles accomplish quite remarkable results in the control of many processes, ranging from simple variables—such as position, temperature, voltage, and pressure—to the control of complicated processes—such as integrated power systems, industrial manufacturing processes, and space vehicles. As a challenge to our intellectual capabilities, let us see how control systems principles might be

applied toward improving international relations.

How would you approach this problem?

- You would be able to consult and work with most any person you would desire, since there is a great deal of interest in the subject of improving international relations and stability.
- You could get information of an unclassified nature about what is going on in the world, and you would be able to monitor activities that might be likely to cause war while they were still in the formative stage.
- You could help bring about some changes in the laws and in the general ways of doing business, nationally and internationally.

### General Approach

As a general approach to the problem of improving international stability, one might view the opportunity as one of changing the perception of what is needed to be done from an open-loop situation of reacting to unstabilizing activities as they occur to a closed-loop situation in which possible causes of instability could be identified and their condition monitored. Based on mutual understanding of the possible causes of instability and the various ways available for decreasing the likelihood of instability to occur, it should be possible to significantly reduce the number of conflicts that were allowed to be of more than minor difficulty. Further, by having local, regional, and even higher levels of international conflict resolution available for settling such international disputes, there would be more chances to find ways of settling the disputes that cannot be settled at the lower levels. All international conflicts need not have world attention in their initial stages. As a useful step in this direction, means should be established to develop cooperative security systems to encourage the nations involved to seek peaceful means of resolving their differences.

### Block Diagram of a Single Nation

The figure shows a simplistic block diagram for a single nation in which the nation's

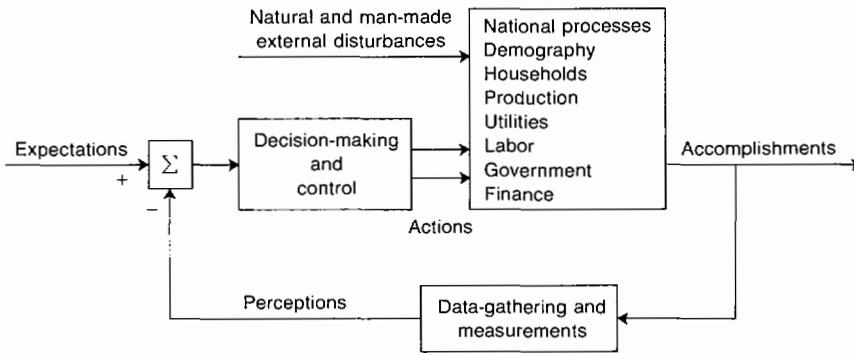


Fig. 1. Block diagram for a single nation.

accomplishments are the outputs of the national processes. These outputs are measured and have data gathered on them to provide perceptions of what is happening in the country. The perceptions are compared to the expectations of the country. The discrepancies between the national expectations and the perceptions represent inputs to a decision-making and control process that produces outputs of actions that should modify the national processes to bring them into closer correspondence with the national expectations and aspirations.

Note that the national processes have natural and man-made disturbances that may upset them from their anticipated values. Likewise, there may be perceived external disturbances, which may influence decision-making and control and cause it to function in other than the best fashion. Thus, although the expectations-accomplishment loop appears to be quite controllable, there is enough uncertainty and delay in some of the national processes that it is by no means certain that control of the national processes can be readily realized in a stable fashion.

In the next level of complexity, it should be noted that the expectations of the nations are themselves an input from an understanding and comprehension process. This process itself has inputs from information derived from basic knowledge and understanding, from data-gathering and measurements from this and other nations, as well as the disturbances. From this outer loop of information, it is possible to provide still other influences on the national processes, which can cause them to behave in ways different than would be the case if they were operated by themselves alone.

### Peace-War-Peace Cycle

Four major stages in the peace-war-peace time cycle can be described as follows: (1) peace and industrial development, (2) preparedness for military activity, (3) exercises

and precipitating incidents, and (4) war, armed conflict, destruction, and cessation.

Note that it is not necessary that each stage occur and, ideally, only the first stage—peace and industrial development—should be used. Under the peace condition, increases in the national wealth of the order of several percent per year can be realized. It is not necessary to go to war in the peace-war-peace process, because at the end of each stage, there is a feedback path, which does not proceed to the next major stage of the peace-war-peace cycle. For example, after the third stage of exercises and precipitating incidents, there could be peace through confrontation. In contrast with increases in national wealth during peace, decreases in national wealth of many percent per year may be incurred during a modern war.

### Major Causes for War Among Nations

In thinking about the peace-war-peace process, it is worthwhile to keep in mind that a number of major causes for conflicts among nations have been identified in the past. Many previous conflicts have been analyzed, and observations and conclusions have been drawn indicating causes, reasons, and contributing factors. There are many different causes for conflict, and any group of people charged with trying to anticipate and avoid future wars must look at a plethora of possible causes. For example, possible causes of international conflict might be geographic, religious, economic, environmental, raw materials, political, military, or personal.

It is worthwhile to recognize that, for any pair of countries, there may be several possible causes for conflict. It is important to identify the specific causes apparently significant at the time for the countries involved. In this way, closer attention can be given to those factors that appear most likely

to be of a decisive character for these countries.

### Decision-Making and Control

In addition to the identification of the pertinent causes of conflict, the decision-making and control processes should endeavor to establish whether the relationships between countries are "normal," "alert," or "emergency." Since the decision-making and control processes may be quite different for nations in each of these different states, the nature of the appropriate actions for decision-making and control may likewise be different.

It is desirable to work out the suitable action for each of the three states under different scenarios, and causes and conditions. It is important that decision-makers identify not only their own perception of what is happening, but they should also identify what the other country perceives to be happening. The decision-makers should also consider ways in which attitudes of cooperation, competition, and confrontation can be used to influence other decision-makers and to achieve peaceful objectives. In particular, the results likely to be achieved under the conditions of peacekeeping, peacemaking, and peacebuilding should be investigated. It would appear that adaptive and predictive control means could be used for the problems dealt with here.

### Conclusion

As control engineers and scientists, we have greatly altered the way people and nations live and interact with one another. We have helped to create a world in which people live longer, enjoy better health, are better educated, and can travel and communicate over greater distances. But the systems that provide these better lives are fragile systems subject to unpredictable failures and possible destruction. We have also helped to create a world in which international relations are such that the very civilizations we have helped to build over centuries can be destroyed in a matter of hours.

I believe that there are many of you who share my feeling that control systems people, working with persons skilled in other professions, can increase the likelihood for a considerable improvement in international relations in the years ahead. I would welcome hearing from those of you who share my belief for success in applying control principles to improve international relations. My address is in care of the SWIIS Foundation, Inc., 1226 Waverly Place, Schenectady, NY 12308.