

# OPTIMIZATION OF DYNAMIC CONTROL PROBLEMS USING BIONIC APPROACHES

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Today's Bionic Optimization approaches prove to be able to deal with non-trivial optimization challenges. The presence of many local optima is not a real limitation to their ability to find good solutions. However, the non-uniqueness of the solutions found might be a challenge. Classical control theory covers successfully most of the questions posed at dynamic transport problems. Nevertheless, in non-linear problems, the classical tools might be not too efficient or even not well applicable. However, we can transform most of the control problems into optimization tasks, e.g. by minimizing deficits of the solutions found. In consequence, we replace the control problem by an optimization problem. Then we use Bionic Optimization to deal with the given task even in the presence of strong nonlinearities and many optimization parameters.

This idea expands to reliability and robustness studies as well. Therefore, we may handle the inevitable scatter of design parameters of the proposals, which potentially will not work properly under service conditions. In consequence, we combine optimization, robustness and reliability studies into one integrated optimization process.

Cranes with long ropes help demonstrate the performance of such control strategies. After a travel history, the crane is supposed to place the payload at a given position. During the travel and a short time interval following the travel, the driving system acts to perform additional positioning steps to satisfy the requirements of the transport and final position.

In the case of 2D and 3D travels, the non-linearity and long travel times require studies, which do not converge after small numbers of iterations. Some examples of 1D- and 2D-crane problems help to understand the questions posed and to outline the solutions we like to apply to the problems mentioned. We present advantages as well as critical cases of the approaches used and discuss the benefits. In consequence, the use of advanced optimization tools helps in many cases to solve problems, which are difficult to handle without using these tools.

## REFERENCES

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