

The purpose of this project is to implement a computation tool to obtain the structure at infinity of a multivariable linear system. It is a sort of particular Smith-MacMillan form computed in an analog way as the classical Smith-MacMillan form for computing the finite zeros and poles using normal elementary matrices. Here, the elementary operations are slightly different. But overall it is a similar process that lends to computer implementation. The purpose is to write the code so as to compute the Smith-MacMillan form of a rational matrix at infinity. The method is described in [1].

- Write the computer code for the classical Smith form decomposition of a polynomial matrix. Implement the algorithm in your favorite computer algebra system (Matlab symbolic toolbox, Maple, Mathematica, CoCoA, Singular, Macaulay2, etc, etc.).
- Go through the article carefully.
- Implement the newly defined Smith form using the newly defined elementary operations.
- Write the computer code for the Smith form decomposition of a rational matrix at infinity.
- Discuss poles and zeros, both finite (first Smith form) and infinite (second Smith form).
- Tests your algorithms on various examples.
- Write a small report (max. 6 pages) describing the main features. Give the code as an appendix to this report (not counted in the page limit).

References

- [1] A. I. G. Vardulakis, Limebeer D. N. J., and N. Karcantias. Structure and Smith-MacMillan form a rational matrix at infinity. *International Journal of Control*, 35(4):701–725, 1982.