7. CONCLUSIONS

An analytical scheme that describes the turbulent mixing zone within an ejector was presented. The model is able to compute all flow properties inside an axisymmetric or planar mixing chamber with either constant or variable cross section. The amount of entrained flow, the work and heat exchange, pressure losses and mixing efficiency are computed as a function of the system geometry and without use of any arbitrary parameter. Consequently, this model is particularly suited for a thermodynamic optimization of the ejector system.

The model was validated by comparison with CFD results for various operating conditions. Results generally showed good agreement in all parameters, with increasing errors as pressure gradient increases. In particular, discrepancy between numerical and theoretical Entrainment Ratio was generally well below 10%.

One of the main problems in the optimization of a supersonic ejector is the decrease of mixing effectiveness with increasing primary stream Mach number. A way to work around this problem is to enlarge and optimize the contact surfaces between primary and secondary stream.

A preliminary study was performed in this direction. Results demonstrated that splitting the primary mass flow into several smaller nozzles (ceteris paribus), notably increases the entrainment of the secondary flow.

This result leads the way to new design configurations that may be optimized by means of a constructal approach. The Q1D model presented here is particularly suitable to this aim, in that it envisions the ejector as an equivalent "momentum exchanger". Consequently, many of the Constructal design concepts that were developed for the optimization of heat exchangers may be applied.

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