

## PREFACE

In the recent past, people have used jet pumps in many diversified fields and at times, in fascinating areas like nuclear power station, space vehicle, deep sea - mining, dredging etc. My interest in the area of pipeline transportation of solids coupled with the diversified applications of two phase jet pumps (water as primary fluid and water-solid mixture as secondary fluid) inspired me to take up this problem on "Dynamics of Jet Pumps - with specific reference to Hydraulic Transportation of Solids " for investigation.

Although a good amount of information is available on liquid-liquid jet pumps, not much, however, is available on two phase jet pumps (solids handling jet pumps). From the literature review it is apparent that most of the works on jet pumps rely on many experimental coefficients which have to be used for general case with reservation. The mixing of two coaxial jets being the heart of the problem, has not been given due importance in the existing literature. As such, the purpose of present work is to investigate the problem afresh. The basic problem lies in correctly estimating (i) the pressure distribution along flow axis and (ii) the velocity distribution at a section for several geometrical and flow variations of the single as well as two phase jet pumps. Before attempting the investigation of the problem on two phase jet pumps it became imperative to put the dynamics of jet pumps for single phase jet pumps on a stronger footing.

Next, the model was extended to take care of solid-liquid mixture on the secondary side of the jet pump.

The reliable and extensive experimental data generated on a well designed and fabricated test rig by Sanger at NASA laboratories was a good wealth of information on liquid-liquid jet pumps and this was used to check the validity of the theoretical model proposed in this investigation. For two phase jet pumps, fresh experimental data was generated on a test rig designed and fabricated specially for this investigation. Two types of solids - Sand and P.V.C. granules - were used in the investigation.

The present report is divided into six chapters, each highlighting a distinct aspect of the problem.

Major applications of the Jet-Lift systems for hydraulic transportation with specific reference to dredging and deep-sea mining are briefly discussed in Chapter I. In Chapter II, the important available literature on the subject has been reviewed. The equations proposed by various researchers have been reported in this chapter along with the range of variables for different parameters. A new theoretical approach to explain the mixing behaviour of two coaxial jets under different initial conditions has been proposed in Chapter III. Further, a method to explain the flow behaviour of solid-liquid mixture through ducts of various cross sections in steady state and established flow conditions applicable to Jet-Lift system has been given in

this chapter. The details of experimental set-up, experimental procedure and investigations have been presented in Chapter IV. The comparison of the theoretical investigations with (i) the experimental data of Sanger and (ii) the data generated using the present set-up have been discussed in Chapter V. The conclusions and the scope for further work have been given in Chapter VI. The effect of important parameters on jet pump performance has also been highlighted in this chapter.

Each chapter contains a brief introduction and deliberations on a particular aspect of the problem. S.I.system of units has been used all through the report, except at places where researchers have reported in other system of units.