ROV Math for More Thrusters than Degrees of Freedom

The ROV has 6 degrees of freedom; this requires 6 thrusters. If there are more than 6 thrusters this can still be handled.

The basic matrix equation looks like: [A] {f} = {F}

Where [A] is the matrix of the contributions of each thruster to each DOF;

{f} is the thrust for each thruster (which is what we want to find);

{F} is the pilot’s inputs commanding the desired response of the vehicle (move forward/ rotate left/ etc or some combination)

Ordinarily, our matrix has six columns (one for each thruster) and six rows (one for each DOF: x/y/z/rotx/roty/rotz). Down each column is the contribution of one thruster to each DOF. Let’s say your ROV has 8 thrusters then [A] will have 8 columns and 6 rows. We need a 6 x 6 matrix to solve for the 6 degrees of freedom. To convert to a 6 x 6 matrix multiply [A] by its transpose (call the transpose [A]T) ([A] \* [A]T); this results in a 6 x 6. Solve this in the usual way obtaining results for 6 degrees of freedom; call this result {f6}. To convert this to the 8 thrusters on the ROV multiply [A]T \* {f6} ={f8}. {f8} has 8 rows so you will have the thrust level for each of the 8 thrusters.