1046-65-1935 **F. Olcay Ilicasu*** (`ilicasu@rowan.edu`), Mathematics Department, 201 Mullica Hill Road, Glassboro, NJ 08028, and **David H Schultz** and **Bakhadirzhon Siddikov**. *Developing 3rd, 4th and 5th order Difference Techniques on a Singular Perturbation Problem and Their Stability Comparison.* Preliminary report.

A one-dimensional convection-diffusion equation

$$-\epsilon y''(x) + u(x)y'(x) = f(x), y(0) = \alpha, y(1) = \beta, \tag{1}$$

where $0 < \epsilon << 1$ is a constant,$u(x) \equiv 1$,and α, β are real numbers,is considered.From (1),

$$u''(x) - \omega u'(x) + \omega f(x) = 0, where \omega = 1/\epsilon. \tag{2}$$

3 points are used to develop a 3rd order method to approximate the lhs of(2)as in

$$u''(x_i) - \omega u'(x_i) + \omega f(x_i) = \alpha_i y_i + \alpha_{i+1} y_{i+1} + \alpha_{i-1} y_{i-1} + \beta_i \tag{3}$$

For the third order technique,we expand y_{i+1} & y_{i-1}in Taylor Series around x_i up to the 4th derivative term.

$$\begin{aligned} LHS = \alpha_i y_i + \alpha_{i+1}\{y_i + hy_i' + \frac{h^2}{2}y_i'' + \frac{h^3}{6}y_i''' + \frac{h^4}{24}y^{iv} + \ldots\} \\ \alpha_{i-1}\{y_i - hy_i' + \frac{h^2}{2}y_i'' - \frac{h^3}{6}y_i''' + \frac{h^4}{24}y^{iv} + \ldots\} + \beta_i. \end{aligned} \tag{4}$$

From (2), y_i'' is written in terms of lower order derivatives.For the 4th and 5th order methods, we consider the next derivative terms in Taylor expansions and proceed in a similar manner.Finally, we apply these techniques on 2 test problems and compare stability. (Received September 16, 2008)