Introduction to CFD Questions & Answers

Question by Student 201427564

Professor, when you explain about 'Roe Average', you wrote like this. $A_{i+\frac{1}{2}}(U_{i+1} - U_i) = F_{i+1} - F_i$. *I can not understand that how can it be possible that* $A_{i+\frac{1}{2}}U_{i+1} = F_{i+1}$ *and* $A_{i+\frac{1}{2}}U_i = F_i$ *. Because subscript of A and U are different each other.*

Hm, I don't understand the question. You need to explain better what you don't understand..

Question by Student 201427564

Oh.. I mean How can it be possible that $A_{i+\frac{1}{2}}U_{i+1} = F_{i+1}$ *rather than* $F_{i+\frac{1}{2}}$ *. Are there any rules?*

I'm not sure what you mean. But it is not correct that $A_{i+1/2}U_{i+1} = F_{i+1}$. This is not the Roe average. The Roe average if $\Delta F = A_{i+1/2}\Delta U$. I'll give you 0.5 point for the effort.

Question by Student 201427102

Professor, I'm confused. For finding $F^-_{i+1/2}$*, you used below form.*

$$r_i^- = \frac{F_i^- - F_{i+1}^-}{F_{i+1}^- - F_{i+2}^-}$$

According to table, this form for alpha < 0*. But alpha* > 0 *at Q#2 of assign.#8.*

What does "alpha" mean? I didn't use this in class. You need to rephrase your question and use the same symbols as used in class. Or, define clearly a new symbol you are introducing.

Question by Student 201427102

Professor, I'm confused. For finding $F^-{}_{i+1/2}$*, you used below form.*

$$r_i^- = \frac{F^-{}_i - F^-{}_{i+1}}{F^-{}_{i+1} - F^-{}_{i+2}}$$

According to table, this form for a< 0*. But a*>0 *at Q#2 of assign .*

Node	u, m/s	a, m/s
$i-1$	0	100
i	10	110
$i+1$	9	105
$i+2$	-10	100

Now I see what you mean. When dealing with a system of equations, the wave speeds are not necessarily a or u. Rather, the wave speeds are the eigenvalues. So, when determining $F^{\pm}_{i+1/2}$, the wave speeds are within $\Lambda^{\pm}$ (those play the same role as the "a" does for a scalar equation). 1.5 point bonus.

Question by Student 201427564

Professor, I have a question about $\phi(r)$*. In the table,* $\phi(r) = max(0, min(1, r))$*. But last class, you wrote like this.* $(\phi^+{}_{i+\frac{1}{2}})_1 = max(0, min(1, 2r^+{}_i))$ *Why did you use* $2r^+{}_i$ *rather than* $r^+{}_i$ *?*

Both $\phi = \max(0, \min(1, r))$ and $\phi = \max(0, \min(1, 2r))$ respect the rule of the positive coefficients and reduce to first order at extrema and are hence valid. But $\phi = \max(0, \min(1, 2r))$ is better because it is closer to the second-order stencil. 1.0 point bonus.