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☆ Course / 9 Convergence, Accuracy, and an IVP Solver / 9.2 Accuracy and Convergence



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9	.2.1 Accura	cy and	Conver	gence		
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MO2.4	MO2.6
14102.4	14102.0

As the timestep is decreased, i.e.  $\Delta t 
ightarrow 0$ , we would like our numerical method to better approximate the exact solution to the model equations. Let's define the error in our approximation at timestep n to be:

$$e^n \equiv v^n - u(t^n) \tag{9.1}$$

Since this is  $\underline{u}\left(t^{n}
ight)$  is in general an M-dimensional vector of states, then so are  $\underline{v}^n$  and  $\underline{e}^n$ . We can define the components of this error then,

$$e_m^n = v_m^n - u_m \left( t^n \right) \tag{9.2}$$

(9.3)

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for each m=0 to M-1. Then, to measure the r the entire simulation (i.e. over all timesteps),

we'll take the maximum magnitude,

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$$\underline{\mathsf{About}} \qquad \qquad (e_m)_{\max} = \max_n |e_m^n|$$

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Then, in terms of these error definitions, we desire Cather the maximum error in each state goes to zero as  $\Lambda t \rightarrow 0$ . This concept is known as convergence and is stated mathematically as follows:

## Legation 2 (Convergence).

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Prily aumerical method for an Initial Value Problem is

Accounting the property  $t=t_I$  to  $t_F$  if for all m,

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$$rac{ ext{Sitemap}}{ ext{Cookie Policy}}(e_m)_{ ext{max}} o 0 \qquad ext{as} \qquad \Delta t o 0.$$

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While convergence is a clear requirement for a good

Compression that the method converges is also important. This rate is known as the order of accuracy. Contact Us

Help Center Definition 3 (Order of Accuracy).

Media Kit A method has an order of accuracy of  $m{p}$  if, for all  $m{m}$ ,













$$\Delta t 
ightarrow 0,$$





Some important comments:

 $\left(e_{m}
ight)_{ ext{max}}=C\Delta t^{p} \qquad ext{as} \qquad \Delta t
ightarrow 0.$