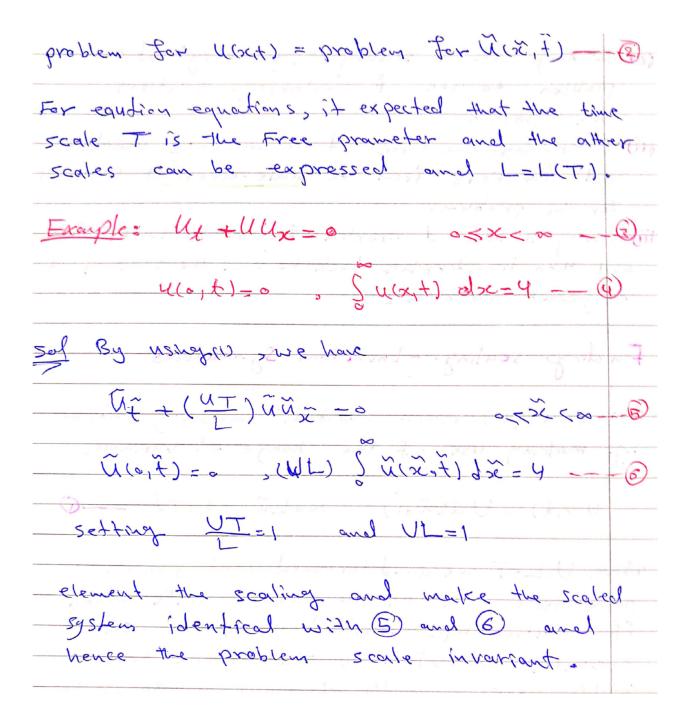
Lecture 6:

Self-Similar Scaling salutions of DEqu-	
	1
linear equation or PDEs nonlinear equactions	1
	3
sparochion of variables similarity method	3
Laplace transformstray transling waive	Solu 3
forrier transformtion	2
- hat had a fact that the first that the fact that the fac	
For nonlinear problems , we will show that if the	e
PDE can be scaled in such a way as to exact	The state of the s
peproduce it original form (as suggested by the	
form 'self-similar'), then it will prossess a chi	ass
of solutions that share this property. A conseq	Newco
of the property of self-similarity is the	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
these solutions can be obtained from a	
reduced version of the original problem.	
For a PDE with two independent variables the	2
leads to an ODE problem for the similarity	
solution. Despite their nature as exact solution	20
te a give problem under special conditions, t	they
after provide important understanding af h	he
often provide important understanding of the sy	stem-
The process of constructing a similarity solver to a given problem consists of three stage	licy
to a given problem consists of three shay	es :

(i) Looking. For a scaling "symmetry" of the problem to see it similarity solutions are possible-(ii) Determining the forms of the Similarity variables and functions from the scale-invariant IT groups for the problem. (iii) solving a reduced problem for the similarity and then transforming tack to give the solution of original problem. Finding sealing - Invertiant Symmetries For U=U(x,t), will admit a similarity saturday by materny use of the change of variables u(x,t) = V ~(x,x) = x= Lx . t=Tt -Where UsLoT are undetermined real positive parameters. we call the problem scale invariant if relationships exist between the socaling parameters U, L, Tin (1) that make the scaled problem take exactly the same as the original problem with at lest : One scatting prometer remining undetermined.



If b=0 => TT = UT => {T6] = UT = T From above F(To Tt2) 50 Appling the implicit function theorem gives f=f(1) == t2u= f(x, t2) -> ((x,+) = t = f(x,+) If we select C=0 _ ?? Example / Uz = Uzx use the scaling (1) fred 1 and solve if with (1) So u(x,t) dx = S u(x,0) dx = M (2) U(o(t)=1 u-00 as 2c 000.

シレーアな シレニアを -> ucout 1 = T = a(Tise , T'x) For arbitary of T. The fransformation is contract scaling symmetry of (3) we define a scale - promotent promoter TT as or Maningtal product cowers of the variables of the system $T = u^a + c$ [80] let ETTI represent the dependence of IT on the scaling ETTJ = ULT In particular for (7), this yeileds ETT] = T = T = T = T If a=0, b=1 from 8) T=xt = [T]=LTT $[T,] = T^{\frac{1}{2}+c} \qquad \qquad C = -\frac{1}{2}$ If n= TT, = > (n= >(+2)

