

Applications of $A = LU$

So what is the value of the factorization $A = LU$? In essence $Ax = b$ has been replaced with two new systems:

$$Ux = c \quad \text{and} \quad Lc = b$$

Start with b and solve the second system for c . Then solve the first system for x . Why is this better than just $Ax = b$? Look more closely:

$$\underbrace{Ux = c}$$

linear system for x
upper triangular
back substitution
efficient

$$\underbrace{Lc = b}$$

linear system for c
lower triangular
forward substitution
efficient

This is useful if one needs to solve $Ax = b$ for a large collection of b 's but the same A .