

# Numerical solution of Sturm-Liouville problems

## Clarendon Press - Numerical solution of Sturm

**Boundary conditions:**  
 Suppose  $u(r)$  and  $v(r)$  are solutions to the Sturm-Liouville differential equation  
 $L(u(r)) = \frac{d}{dr} \left[ p(r) \frac{du(r)}{dr} \right] + q(r)u(r) = \lambda r u(r)$ , then  
 $\int_a^b L(u(r)) dr = \int_a^b \left[ \frac{d}{dr} \left( p(r) \frac{du(r)}{dr} \right) + q(r)u(r) \right] dr$   
 $= \int_a^b p(r) \frac{d^2 u(r)}{dr^2} dr - \int_a^b \frac{d}{dr} (p(r)u(r)) dr + \int_a^b q(r)u(r) dr$   
 $= \int_a^b p(r)u''(r) dr - \int_a^b p'(r)u'(r) dr + \int_a^b q(r)u(r) dr$   
 $= p(r)u''(r) \Big|_a^b - \int_a^b (p'(r)u'(r) + q(r)u(r)) dr$   
 $= p(r)u''(r) \Big|_a^b - \int_a^b (L(u(r))) dr$

If we assume to choose the boundary conditions so that  $p(r)u''(r) \Big|_a^b = 0$  for any two solutions  $u$  and  $v$ , then the Sturm-Liouville self-adjoint operator satisfies:  
 $\int_a^b L(u(r)) dr = \int_a^b (L(v)) dr$

The operator  $L$  is then a **Hermitian operator**. That is  
 $L = \overline{L}$   
 $\int_a^b (p(r)u''(r) + q(r)u(r)) dr = \int_b^a (p(r)v''(r) + q(r)v(r)) dr$

Description: -

- Sturm-Liouville equation -- Numerical solutions.Numerical solution of Sturm-Liouville problems

- Monographs on numerical analysisNumerical solution of Sturm-

Liouville problems

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## Numerical solution of Sturm

This exposition also reveals many open questions that deserves furth.

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## Numerical Solution of Sturm

Then the SLT for the string model considered here is investigated. Without the realizability, the physical system simply cannot be built.

## Numerical Solution of Sturm

In conclusion, we mention the next theorem. I do not pretend to be exhaustive nor even to quote every important contribution if a reference does not appear be. The Sturm-Liouville problem S-L, for short consists of two parts: the first part is about finding such values of parameter  $\lambda$  for which the problem has a nontrivial solution not identically zero ; such values are called eigenvalues.

## Numerical solution of Sturm

Loosely speaking, we may assume that the structural constraint and the spectral constraint define, respectively, smooth manifo. .

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. When the two constraints cannot be satisfied simultaneously, the IEP could be formulat.

## MATHEMATICA tutorial, Part 2.5: Sturm

Approximate resolution of linear systems of differential equations with varying coefficients is a recurrent problem shared by a number of scientific and engineering areas, ranging from Quantum Mechanics to Control Theory. Of course, we do not pretend to be exhaustive nor even to quote every important contribution .

### **Oscillation theory and numerical solution of fourth**

The uncertainty arises when there is simply no accurate way to measure the spectrum or there is no reasonable means to obtain the entire information.

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