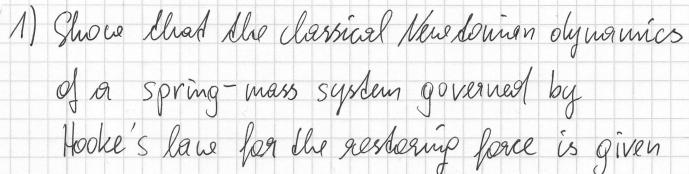
anestions SV 101.368



in the form of a ldamildonian system for the variables x, x (x. displacement).

Show that the damillouin is conserved by the flow.

2) Show that the classical New Lorian dynamics

of a passicle in a force field F = - TV (q)

(q. position) is given in the form of a Hounilbonian

system per ble variables q, p=mg.

Show that the Hamiltonian is conserved by the flow.

3) Consider a system of N particles interacting pairwise with potential forces which depend on the distances

of the particles. This is or lamildoman system weigh

 $H(p,q) = \frac{1}{2} \sum_{i=1}^{n} p_i^T p_i^T + \sum_{i=2}^{n} \sum_{j=1}^{n} V_{ij}(\|q_i - q_j\|),$ $q_i - position of i.dh particle$

Pi ... momendum ef i-th particle

Vij - interaction potential

Write down the equations of motion for 9i, pi, and show that the

luieur momentum pi = \(\frac{1}{\epsilon=1}\) pi

and the

ougular momentum L:= \$\frac{N}{i=1} q_i \times p_i are conserved by the flow.

4) The dune-dependent Schrödinger equation

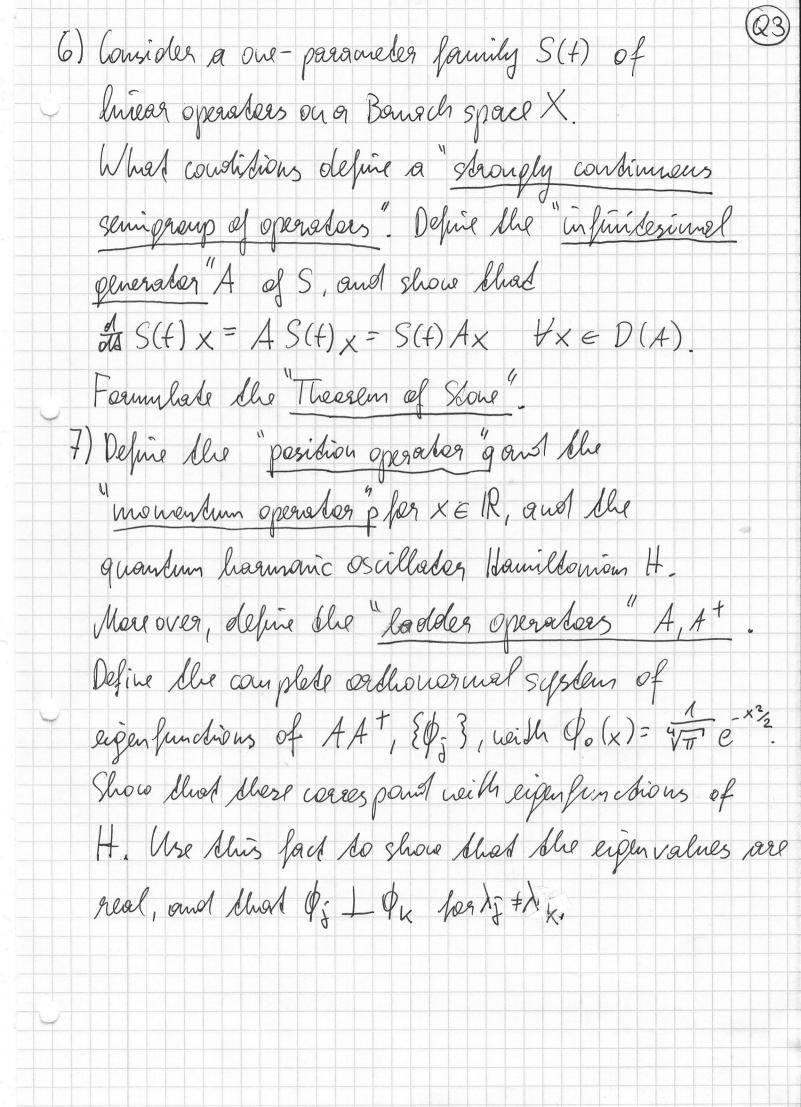
is defined with a self-adjoint operator H on or Liller Space H

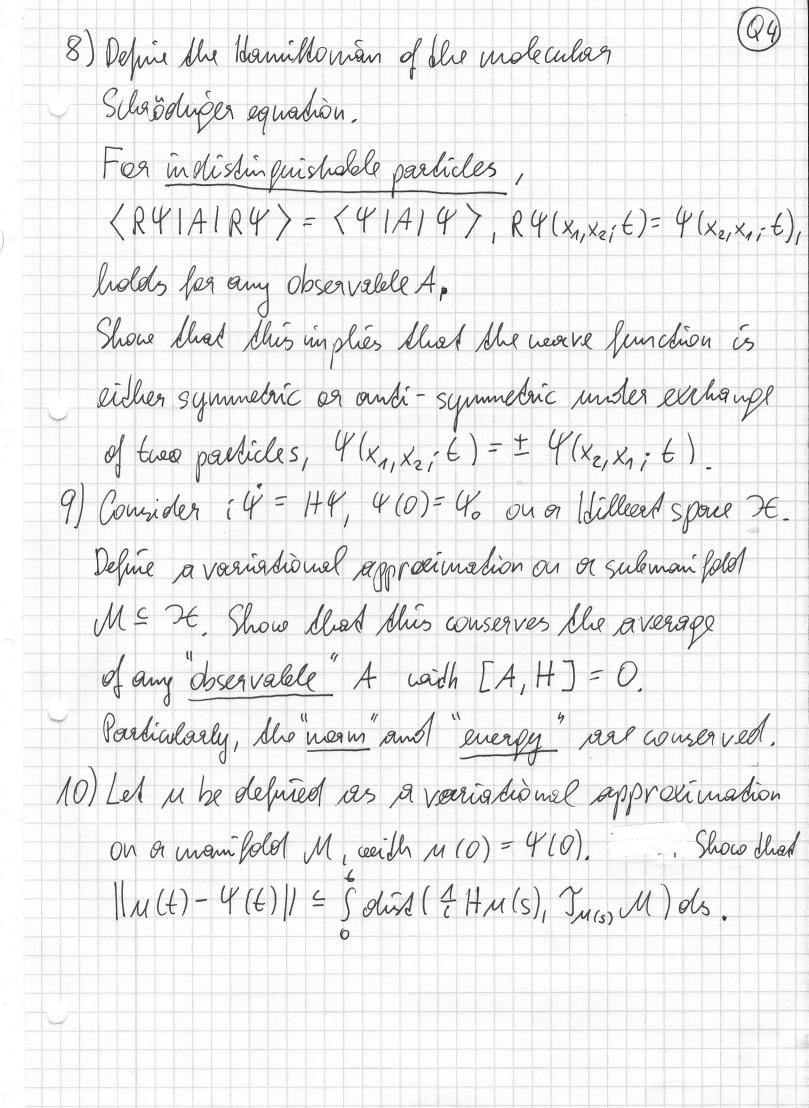
Show that the norm, 11411, and the every, (4/H/4) are conserved along the flow.

What property is segmeed of or self-adjoint operator A so ensure (4/A/4) = cours. ?

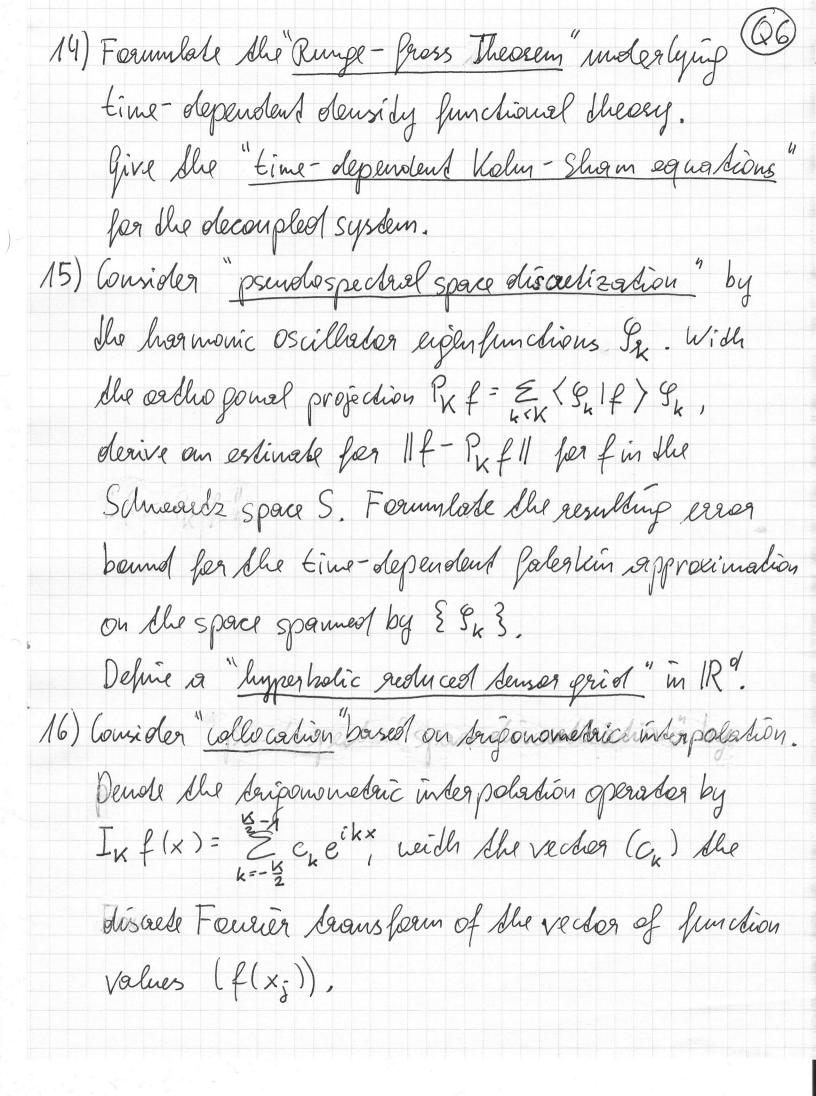
5) Derive on explicit fermula for the solution of the fell Schrödriger equation in 120 $: \Psi = -\frac{1}{2} \Delta \Psi, \quad \Psi(0) = \Psi_0$

by using the Feurier Gransform.





(Q5) M) Consider a time depend million A(t) & IR "x" We want to compute a variational apprecimation on the manifold of matrices of exactly rank v. Give ble variational principle, necessary additional orthogonality constraints and derive ble aquations et motion par S, where A ~ Y = USV. (V,V e IR" ordhoganal, SE IR" nousin gular) 12) Define the method of "Variational Splitting", i.e. or symmetric second-order splid-step time interpreter. What irsumptions on the manifold M, variational appreximetien u, and hinesic and podential operators T and V are used to establish second-order convergence? 13) Define ble approximation manifold used in foursion wave parket olynamics, and formulate the error bound per the associated vorigtie nal approximation.



(Q7) Derive an estimate per 1 f-Ix f 1/2. Fernulate the resulting error leaund for the collocation approximation of the time-dependent problem. 17) Formulale ble Chebysher medhod for dhe compudation of the matrix exponential e-iset, and give an errer bend. What restriction is implied by this error bound? Formbete the recurrence relistion for Chebysher polynomiels underlying Clenshaues Algerillus. 18) Fernulate Lancres Method for the computation of the matrix expandial e-iset. Formulate an error estimate for approximation on the m-th Kaylor subspace associated with A and a vector V, when an approximation for f(A) v is sought her A complex-valued function f. Discuss the implications on step-size choice in the approximation of e-iseA

five snew impersant "plometric properties" of these methods.

20) Consider "Interarchical matrices" for the approximation of the meanfield operator matrix

Vi; = S &i V &; , &i, &; -- compactly supported.

Define a "cluster tree" and give are possible créterion to determine "admissible lebodes".

five the storage requirement and computational completity for computations with hierarchical

matrices.