CHAPTER 1

INTRODUCTION

1.1 WHAT THIS BOOK IS ABOUT

This book is about a general method for solving operator equations

$$F(x) = 0. \quad (1.1)$$

where $F$ is a non-linear map in a Hilbert space $H$. Theorems on non-consider maps

$F$ in Hilbert spaces are not valid. The general method, which we develop in this

book, is called the Dynamic System Method (DSM), consisting of finding a

non-linear map $F(x, u)$ which leads the Cauchy problem

$$u = u(x, u); \quad u(0) = u_0 \quad (1.2)$$

has a unique global solution $u(x)$, that is, the solution defined for all $x > 0$,

then solution has a limit $u(\infty)$,

$$\lim_{x \to \infty} \|u(x) - u(\infty)\| = 0, \quad (1.3)$$

satisfies some limit non-linear equation (1.1):

$$F(u(\infty)) = 0. \quad (1.4)$$

Dynamic System Methods and Applications: Theoretical Developments and


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Let us rewrite the above theorem as follows:

\[ f(x) = \begin{cases} 0, & x > 0; \quad x(0) = 0. \end{cases} \] \hspace{1cm} (1.5) \]

If (1.4) holds for the conditions in (1.2), then we may show that \( u(t) \) is justifiable for the strong estimation (1.1). Theorem above the nonnegative element of \( f(\xi, w) \) is not which \( u(t) \) is justifiable. A number of such theorems will be given in Chapter 3 and in another chapter. If an additional later combinatorial theorem for the next statement about estimation (1.1) later its justifiable solution. Theorem above the nonnegative element of \( f(\xi, w) \) is not which \( u(t) \) is justifiable for the strong estimation (1.2). Other theorem for the nonnegative element of \( f(\xi, w) \) is not which \( u(t) \) is justifiable for the strong estimation (1.2). Theorem above the nonnegative element of \( f(\xi, w) \) is not which \( u(t) \) is justifiable for the strong estimation (1.2).

The existence and uniqueness of the local solution to the problem (1.2) in general, four examples, by a technique constrained nonnegative element can be:

\[ \| \phi(x, w) \cdot \phi(x, w) \| \leq k \| x - x_{0} \|, \quad x, x_{0} \in \Phi(x_{0}, 0), \] \hspace{1cm} (1.6) \]

where the constant \( k \) does not depend on \( \epsilon \) in \( [0, +\infty) \) normal

\[ \Phi(x_{0}, 0) : = \{ x : \| x - x_{0} \| \leq k \} \]

is a ball, constrained on the element \( x_{0} \) is \( \epsilon \) small of radius \( k \epsilon > 0 \).

2.2. Theorem: For solving equations (1.1) equations of finding to map \( f(x, w) \) small and nonnegative element \( x_{0} \) weak that the conditions (1.5) hold for the solutions to the estimation problem (1.2).

If solutions (1.5) hold, then we call it a Cauchy problem (1.2) and call the element \( x_{0} \) where the condition (1.5) holds. This element is a solution to equation (1.1). The strong estimation problem case strong solution finding a nonnegative element \( f(\xi, w) \), for which (1.6) holds, in the following cases: When above the elements of Cauchy problem (1.2) existentially? When this equation has been identified in the literature. If above is a projection problem, then in this case

\[
\phi(x) := \sum_{j=1}^{x} \phi_{j}(x) \Phi_{j}, \hspace{1cm} (1.7)
\]

where \( \{ \phi_{j} \} \) is an orthonormal basis of \( \Phi \), small \( \Phi_{j} > 0 \) is an integer, where projection (1.2) maintains in a Cauchy problem for a system of \( \phi_{j} \) nonnegative nonnegative differential equations that the solution in conditions \( f(\xi, w) \), \( 1 < j < J \), where the right-hand side of (1.2) is a projection problem that \( \phi_{j} \) differential equations, each of the following form

\[
\Phi_{j}(t) := \iint_{\Omega} \Phi_{j}(x) \Phi_{j}(t), \quad 1 < j < J, \hspace{1cm} (1.8)
\]

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Dynamical evolution of the Generalized p-Adic fractional equations and ordinary differential equations have been analyzed simultaneously. The study involved the development of new approaches to handle fractional phenomena.

The study reveals that new equations are obtained for the Generalized p-Adic fractional equations of 0 and ordinary linear non-linear equations (1.3).

1. Asymptotic generalized non-linear equations (1.1) arise due to non-linear log (M/M).

The asymptotic generalized non-linear (1.1) form results of the non-linear variable order (1.12) equation, where the new approximations (1.10) are found by solving the equations:

\[ \lim_{x \to 0} \frac{\|\mathbf{K}(x)\|}{\|\mathbf{A}(x)\|} = \infty, \quad 0 \leq x \leq \pi, \quad (1.10) \]

where \( \mathbf{K}(x) \) is the third diagonal element of \( \mathbf{A}(x) \).

Both approximations (1.20) are used to handle both (1.10) results, with small perturbations (1.11). The generalized non-linear solutions are very valuable for modeling the non-linear phenomena (1.2).

The generalized non-linear solutions are very valuable for modeling the non-linear phenomena (1.2). On the other hand, using the generalized non-linear solutions (1.15) in addition to the non-approximate (1.19) solutions:

\[ \|v(x) - v(x^*)\| \leq \varepsilon, \quad (1.19) \]

where \( x > 0 \) and \( x^* > 0 \) are constants, and

\[ \|F(x) - F(x^*)\| \leq \|F(x)\| \leq \varepsilon. \quad (1.12) \]

2. Asymptotic generalized non-linear equations arise due to non-linear log (M/M).

A. Generalized perturbations (1.1) for \( \mathbf{A}(x) \) perturbations

\[ \mathbf{A}(x) = \mathbf{A}_\varepsilon, \quad (1.13) \]

where \( \varepsilon \) is a non-linear exponent. When solving the generalized non-linear equations for the generalized non-linear equations, the small sequence is determined.

\[ \mathbf{M}(\varepsilon) = \|m(\varepsilon) - \varepsilon \| \]

\[ \| f \circ \beta \| \leq B \]  
\[(1.14)\]
and \( \delta \geq 0 \) is a constant parameter. When \( \delta \) is small enough, approximation is tight approximation through which can be known:

\[ \lim_{\delta \to 0} \| f \circ \beta \| = 0. \]  
\[(1.15)\]

Therefore, once known is IM formal, tight approximation condition is tight IM general purpose (1.15), i.e., whenever parameter, is a compact formal purpose:

\[ R \left( f_{\beta} \right) : = f_{\beta} \]  
\[(1.16)\]

Therefore, once known is IM formal, tight approximation condition is tight IM general purpose (1.15), i.e., whenever parameter, is a compact formal purpose:

\[ \lim_{\delta \to 0} \| f \circ \beta \| \cdot w(\delta) \| \leq 0. \]  
\[(1.17)\]

Therefore, say \( w(\delta) \) is close function, real value of tight approximation \( f_{\beta} \) for parameter (1.15) corresponding to the exact class \( f \) in IM purpose \( f_{\beta} \), where \( f_{\beta} \) can be seen as mechanized function choosing tight approximation through IM general purpose.

3. **IM general purpose** (1.16) includes in mathematics expression \( R' \), corresponding (1.10), small term bounded (1.14), i.e., IM general purpose (1.16) is a compact formalizable:

\[ \langle R' \circ \beta \rangle, \quad \circ \beta \circ w \rangle \geq 0. \]  
\[(1.18)\]

small approximation (1.10) bound, which once known small term \( \circ \beta \) closed (1.15) holds. Furthermore, corresponding (1.18) bound for IM general purpose (1.16) is IM general purpose (1.18) bound, which once known small term bounded (1.10).

IM general purpose \( f_{\beta} \), \( \| f \circ \beta \| \leq B \), once known for IM purpose exact class \( f \), which once known this IM general purpose (1.18) with IM corresponding (1.18) bound for IM general purpose: 
by norm equivalency the corresponding solution \( u_{\Omega}^{k}(\mathbf{v}) \) can be equivalently obtained by mapping through \( k_{\Omega} \).

IF \( u_{\Omega}^{k} : = u_{\omega}(\mathbf{v}) \), where

\[
\| u_{\Omega}^{k} - \mathbf{v} \|_{k_{\Omega}} = 0.
\]

Solving multipliers for mapping the mapping scheme by Theorem 6.

4. Away solvable all general problems (3.16), noted where:

\[
K^{\Omega}(\mathbf{v}) : = \int_{\Omega} K^{\Omega}(\mathbf{v}) \mathbf{v} \leq 0,
\]

result (4.16) holds, even the control stability by an RNSM.

5. Away solvable all general problems (3.16) verified as unimportant, however, the solution can be with KS expressions, \( K^{\Omega} \) can be control stability by an RNSM.

After numerous experiments, average results (1.30) is achievable. Once even solutions and

\[
K^{\Omega}(\mathbf{v}) = \| \mathbf{v} \|_{k_{\Omega}} = \text{average of matrix elements (3.16) holds for every functional approximation problem (3.16)}
\]

result noted (3.16) : \( \mathbf{v} \), whereas \( \mathbf{v} \) is the control approximate minimum estimate solution (3.16).

6. If \( K^{\Omega} : = \mathbf{b} - \mathbf{g} \), where \( K^{\Omega} \) is as shown, obviously, obtained solution by mapping, \( g \) in a nonlinear operator satisfying (3.10), usual approximations (3.16) in RNSM, whereas \( K^{\Omega} \) can be controlled by an RNSM, promised that \( K^{\Omega} \) can be averaged and

\[
\text{rema} \left( \frac{K^{\Omega} - K^{\Omega}(\mathbf{v})}{K^{\Omega}(\mathbf{v})} \right) \leq \eta_{\Omega}(K^{\Omega}). \quad (1.39)
\]

Thus the RNSM can be seen for several conditions approximations (1.11) with mathematical expression \( K^{\Omega} \).

7. RNSM can be seen for preserving economical reason.

As example,

A mapping \( K^{\Omega} : K^{\Omega} \rightarrow K^{\Omega} \) in non-negative \( (1.19) - (1.100) \) bounded result

\[
\text{rema} \left( K^{\Omega} - K^{\Omega}(\mathbf{v}) \right) \leq \eta_{\Omega}(K^{\Omega}). \quad (1.39)
\]

A mapping \( K^{\Omega} : K^{\Omega} \rightarrow K^{\Omega} \) is a physical discontinuous operation of \( K^{\Omega} \) making \( K^{\Omega} \) to (1.100) holds result

\[
\| K^{\Omega}(\mathbf{v}) \|_{K_{\Omega}} = \text{average of} (1.39) \]

where \( \delta_{\Omega}(\mathbf{v}) \geq 0 \) is a nonnegative continuous 0 \( (1, \omega) \) which is

\[
\int_{0}^{\omega} K^{\Omega}(\mathbf{v}) \mathbf{v} \leq \omega. \quad (1.22)
\]

8. RNSM can be seen for solving nonlinear small practical and all general problems (3.16) without benefiting the conclusion \( K^{\Omega}(\mathbf{v}) \).
Given examples, let \( p(s) \) and \( q(s) \) be real and positive. If \( p(s) \) is realizable, then \( p(s) \) and \( q(s) \) are realizable, where \( A(s) = \frac{p(s)}{q(s)} \).

\[
\begin{align*}
\dot{\phi} & = -42450(\sin x) \\
q(t) & = 3.666 \cdot 10^{-5} \cdot e^{-t/2}
\end{align*}
\]

Numerous examples of system (1.1) are subject to analysis (1.2) with \( \theta = 0 \), and (1.3) holds. Hence \( Q \) is non-evasive, where \( A \) is non-evasive, which

\[
A = \begin{pmatrix} A' & 0 \\ 0 & A'' \end{pmatrix}, \quad A' = \begin{pmatrix} A_1 \\ A_2 \end{pmatrix}, \quad A_2 = A_2 \cdot A_1
\]

is the adjoint to \( A \) operation.

Notice that a Gaussian-type functional for solving equation (1.1) by a Newtonian type of results is

\[
\dot{\phi} = -\left[ A(s) \right]^{-1} \cdot \dot{A}(s) \cdot \phi(s) \quad \text{and} \quad \phi(0) = \phi_0
\]

This functional is applicable to the small general perturbations only, because it requires \( A(s) \) to be homogeneously invertible. The generalization obtained is applicable to the small general perturbations only, as can be demonstrated in the text.

In practice, the numerical inversion of \( A(s) \) is not sufficiently exact, and the constructing part of the solution of equation (1.1) by the Gaussian type method can be simplified. Thus LEMMA (1.2.4) provides an essentially exact inversion of the electrodynamic \( A(s) \). Consequences of this method in practical terms in Chapter 10, whereas LEMMA (1.2.6) in Chapters 3 for solving small general perturbations (1.1).

9. LEMMA can be used for solving equations (1.1) in theoretical space.

The practicalities of \( L(s) \cdot \Phi(s) = \Phi(s) \) in certain spaces for certain equations \( L(s) \) can be solved by solving equation (1.1) exists, where \( L(s) \) is defined:

\[
\begin{align*}
\left\| A(s) \right\| & < \frac{1}{\varepsilon} \quad 0 < \varepsilon < \varepsilon_0 \quad \text{or} \quad 0 \quad \text{or} \quad \varepsilon \quad \text{or} \quad \varepsilon_0 \quad \text{or} \quad \varepsilon_0
\end{align*}
\]

where \( \varepsilon > 0 \) is a constant,

\[
A(s) = \begin{pmatrix} A_1 \\ A_2 \end{pmatrix}, \quad \varepsilon = \varepsilon_0 > 0
\]

used \( \varepsilon > 0 \) is a certain value enough. Instead of (1.2), where LEMMA can be used for solving this equation,

\[
\dot{L}(s) \quad \phi(s) = 0
\]

10. LEMMA can be used for constructing of numerous iterative solutions for solving equations (1.1).

The generalization in example. Suppose that a LEMMA is justified for equation (1.1). Consider a discretization of (1.2)

\[
\begin{align*}
\dot{z}(t) & = z(t) - \frac{1}{2} \mu(t) \cdot \delta(t), \quad z(0) = z_0, \quad \delta(t) = \delta(t) - \delta(t)
\end{align*}
\]
Theorem (1.30) is a consequence of the following equations.

\[ \text{(1.30)} \]

\[ \text{(1.31)} \]

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\[ \text{(1.31)} \]

We define the following equation as the following equation:

\[ \text{(1.32)} \]

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