

Modified decomposition method for solving linear Fredholm-Volterra integral equations

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Abstract: In this paper the exact solution of linear Fredholm-Volterra integral equations of the second second kind is presented. Which is obtained by using modified decomposition method and examples are given to show the validity of the method presented.

Key word: exact, modified decomposition method, Fredholm-Volterra integral equations.

I. Introduction:

Modified decomposition method has been applying for a long time to solve Fredholm integral equation and Volterra integral equations[1, 2].

In this aim we used this method to solve linear Fredholm-Volterra integral equations:

The modified decomposition method identifies the zero component $u_0(x)$ by one part of $f(x)$, namely $f_1(x)$ or $f_2(x)$ the other part of $f(x)$ can be added to the component $u_1(x)$ that exists in the standard recurrence relation.

The modified decomposition method admits the use of the modified recurrence relation:

$$u_{k+1}(x) = \lambda \int_a^b k_1(x, t)u_k(t)dt + \lambda \int_a^x k_2(x, t)u_k(t)dt, \quad k \geq 1 \quad (1)$$

Where the solution $u(x)$ is expressed by an infinite sum of components defined by:

Notation:

If $f(x)$ consist one term only, the modified decomposition method cannot be used in this case.

The modified decomposition method will be illustrated by the following examples.

Example(1):

solve the integral equation by use modified decomposition method

Solution:

We first divide $f(x)$ given by

into two parts:

We next use the modified recurrence formula (2) to obtain

It is obvious that each component of $u_j, k \geq 1$ is zero. This in turn gives the exact solution by

Example(2):

solve the integral equation by use modified decomposition method

$$u(x) = x^2 + 1 -$$

Solution:

We first divide $f(x)$ given by

into two parts:

We next use the modified recurrence formula (2) to obtain

$$u_1(x)$$

It is obvious that each component of $u_j, k \geq 1$ is zero. This in turn gives the exact solution by

II. Conclusion

Finding the exact solutions of systems of linear Fredholm-Volterra multi-dimensional integral equations by use the modified decomposition method is a good subject for further research.

References

- [1] Abdul-majid W., "Linear and nonlinear integral equations", Saint Xavier University, 2011.
- [2] Rahman M., "Integral Equation and Their Applications", Dalhousie University, 2007.