_N r r
10.100 /110 -010- -

_N

2 The HAM-based approach

(1,),

$$(1 - p)L[\phi(x;p) - u_0(x)] = p\, N[\phi(x;p)].$$

$p \in [0, 1]$ (1),

$$L[\phi(x;p)] = \frac{\partial^n \phi(x;p)}{\partial x^n}.$$

$$N[\phi(x;p)] = \frac{\partial^n \phi}{\partial x^n} - f\left(x, \phi, \frac{\partial \phi}{\partial x}, \cdots, \frac{\partial^{n-1}\phi}{\partial x^{n-1}}\right),$$

$u_0(x)$ $u(x)$

(1), $u(x)$

$$\{x^n \mid n = 0, 1, 2, \cdots\}$$

$$u(x) = \sum_{n=0}^{+\infty} d_n x^n.$$

$d_n, n = 0, 1, 2, \cdots$ *rule of solution expression*.

( ), $u_0(x)$

$$u_0(x) = x^n + a_{n-1} x^{n-1} + \cdots + a_2 x^2 + a_1 x + a_0,$$

t . T r r , p

r t t r t r ( ), t r t (1) r

$$u_m^{(n)}(x) = \sum_{k=0}^{N+m} d_k x^k. \quad (1\ )$$

r t r t $N+m$ m.

S t t $u_m^{(n)}(x) = x^k$ t t r t (1) r

$$u_m(x) = \frac{k!}{(k+n)!} x^{k+n} + c_{n-1} x^{n-1} + c_{n-2} x^{n-2} + \cdots + c_1 x + c_0. \quad (\ 0)$$

r, (1), $c_0, c_1, \ldots, c_{n-2}, c_{n-1}$ t r t n r t, t (1), (0) t r t L, t

$$u_m(x) = \sum_{k=0}^{N+m} d_k$$

[illegible]

3 Applications

[illegible] (S[illegible] .1

T t r r r t r $u_m(x)$, t mt r r r t t (1) t r t (1) r t

$$u_m(x) = \chi_m u_{m-1}(x) + R_m(\mathbf{u}_{m-1}, x). \quad (10)$$

$$u_m( ) = , \quad u_m( ) = . \quad (11)$$

r

$$R_m(\mathbf{u}_{m-1}, x) = u_{m-1}(x) + u_{m-1}(x) + (- \chi_m) x$$

$$- \sum_{j=0}^{m-1} u_{m-1-j}(x) \sum_{i=0}^{j} u_i(x)\, u_{j-i}(x) \quad ( )$$

t , t $u_m(x), m = , , \ldots$ r r . r , $m =$, (0)

$$u(x) = u(x) + u(x) + x - u(x)$$

$$= - h \; x - x + x - x + x - x + \quad ( )$$

S t r (0)

$$u(x) = \frac{x^{k+}}{(k+)(k+)} - \frac{\quad^{k+} - \quad x}{k(+ k+)} + \frac{\quad^{k+} - }{k(+ k+)}. \quad ( )$$

(1), t r t r r t r

$$u(x) = - \frac{}{}(x -)(x -)$$

$$\times (x - x + x - x + x - x +) \quad ( )$$

$u_m(x), m = , \ldots$ t r .

T mt r r r t r

$$u(x) \approx \sum^{m}$$

t r t ( ), t t t r t t ( ) r t r

$$u \, x = x - x \, . \qquad (1)$$

$$; p = \, . \, \frac{; p}{x} = \, . \; ; p = \qquad (\;)$$

T t r r r t r $u_m \, x$, t mt r r r t t (1) t r t (1) r t

$$u_m \, x = \, m u_m$$

Table 2 t rr r r t t (,)

x		t	10t	1 t
0.1	0.001 0	. −	1. −	. −
0.	0.00 1 10	. −	1. −	1. −
0.	0.010 1 0	. −	1. −	. −
0.	0.01	. −	1. −	. −
0.	0.0 0 0	. −	1. −	. −
0.	0.0	. −	1. −	. −
0.	0.0 0	. −	.0 −	1. −
0.	0.0 1 1	. −	. −	1. −
0.	0.01	. −	. −	1.1 −

t t

$$u \quad x = x \quad - x \qquad (\quad)$$

T r r t - r t . t rt t t t t t r t t t r (1,), t r r S t t t t.

r t r t r r r t t ( ), t r r r t r L

$$L[\quad x; p\ ] = \frac{\quad x; p}{x}. \qquad (\quad)$$

t r r t r $N[\quad x; p\ ]$

$$\frac{\quad x; p}{x} + \quad x; p \quad - \quad x^{-}$$

[redacted]

$$[redacted]\; x = u_0(x) + u_1(x)\; [redacted]$$

$$= x - x + [redacted]$$

$$+ \; - \; x^{-} \; [redacted]$$

[redacted] (0) [redacted]

$$= \frac{k!\, x^{k+}}{(k+\;)!} - \frac{[redacted]}{(k+\;)(k\; [redacted]}$$

[redacted]

$$u(x) = \frac{x}{\;} - \frac{x\; [redacted]}{\;}$$

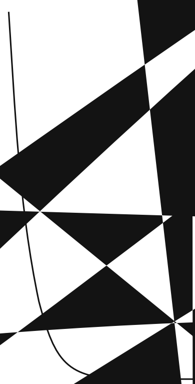
$$+ x - \; [redacted]$$

[redacted] $m =$ [redacted]

$$u(x) \approx \sum_{k=0}^{m} u_k(x) = \sum_{i=0}^{m+} [redacted]$$

[redacted]

Fig [redacted] 1 [redacted] (1, [redacted]



[redacted]

Table 3 t rr r r r t

x	tS	r	t	10t	1 t
0.0 1	0.0	1. −	. −1	. − 1	1. − 1
0.1 1	0.0 0	0. −	1.1 −1	. − 1	. − 1
0. 10	0.0 1	0. −	1. −1	. − 1	.1 − 1
0. 0	0.0 10	0. −	1. −1	. − 1	. − 1
0. 000	0.0	0. −	.1 −1	. − 1	. − 1
0.	0.0 1	0.1 −	. −1	. − 1	. − 1
0. 0	0.0 0	0. −	. −1	. − 1	. − 1
0.	0.01 000	0.0 −	. −1	. − 1	. − 1
0. 0	0.00	0.0 −	. −1	. − 1	. − 1

r t t $m.i$ $m.j$ $m.i.$ $m.j.$ r t . t ( ) r t t t t r (1,) t r t r - tr r t r .

T t r , t - r t 1 t r r r - t ( ) t x = − r . , r t t t t r t − , . − / .

= − , t r t t r r t t t r t t t - r t T , r t r t rr r t - r t -