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Research Article

INTERACTIVE DECISION MAKING APPROACH FOR NASH COOPERATIVE CONTINUOUS STATIC GAMES

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ABSTRACT

This paper, presents a solution method for Nash cooperative continuous static games (which is another type of continuous static games are constructs in this paper) by using interactive approach. This is achieved by using the method of compromise programming and the method of compromise weights from the payoff table of membership function for each cost function. Also we obtain the stability set of the first kind for the solution. The method, called interactive stability compromise programming (ISCP).

INTRODUCTION

Many decision making problems that arise in the real world need to be modelled as vector optimization, continuous static games are another formulations of vector optimization problem (3) by considering the more general case of multiple decision makers, each with their own cost criterion. This generalization introduces the possibility of competition among the system controllers, called "players" and the optimization problem under consideration is therefore termed a "game". Each player in the game controls a specified subset of the system parameters (called his control vector) and seeks to minimize his own scalar cost criterion, subject to specified constraints. Several solution concepts are possible as Nash equilibrium concept, Pareto-minimal concept, min-max concept, min-max counterpoint concept, and Stackelberg leader-follower concept (3).

Nash equilibrium solution

The player act independently, without collaboration with any of the other players, and that each player seek to minimize his cost function .The information available to each player consists of the cost functions and consists for each player.

Min-Max solutions

Each player chooses his control under the assumption that all of the other players have formed a coalition to maximize his cost. The information available to each player consists of his cost function and constraints for each player.

Min-Max counter

Point solutions one of the players has complete knowledge of the cost functions and constraints for the other players and seeks to minimize his own cost, assuming that the other players select min-max controls.

Pareto-minimal solution

Cooperation among all the players is possible. It is assumed that each player helps the others up to the point of disadvantage to himself.

Stackelberg leader-follower solution

One player (the leader) announces his control first .Then the remaining players (the followers) announce their composite control simultaneously. In practice most decision problems have multiple objectives conflicting among themselves. The solution for such problems can only be obtained by trying to get compromises based on the information provided by the decision maker (DM). Several methods have been developed to

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solve multiobjective decision making (MODM) problems (8). In (6) some of these methods are based on prior information required from the DM. This information may be in the form of the desired achievement levels of the objective functions and the ranking of the levels indicating their importance, such as in goal programming. It may also be in the form of weights showing the importance of the objectives. The disadvantage with these methods is that the DM cannot easily provide this prior information since he has no idea about the solution process of the problem. Other methods, called interactive methods have been developed in order to overcome this disadvantage (9, 5, 6, 7). There are two categories of interactive methods. Interactive methods of the first type require the DM to provide some trade-offs among the attained values of the objective functions in order to determine the new solution (1). The interactive methods of the second type require the DM to provide some preference information by comparing the various efficient solutions in the space of the objective functions or the decision variables (10). The quantity and complexity of the information required from the DM in such methods are important factors affecting the chances of reaching the best compromise solution.

This paper, presents formulation of another type of continuous static games called Nash cooperative continuous static games (NCCSG) in which the players are divided into two groups, each one is cooperative and both are playing according to Nash equilibrium solution concept. Also, an interactive stability compromise programming (ISCP) method for solving this type of games is introduced. Finally an algorithm to clarify this interactive approach is introduced.

Problem Formulation

Let us consider the following Nash cooperative continuous static games (NCCSG) problem, each player i= 1,..,r, selects his control vector $u_i \in R^{si}$ seeking to minimize a scalar-valued criterion

$$G_i(x,u) \tag{1}$$

Subject to n equality constraints

$$g(x,u)=0 \tag{2}$$

where $x \in R^n$ is the state vector and $u = (u_1, \ldots, u_r) \in R^s$

$S = s_1 + s_2 + \ldots + s_r$, is the composite control. The composite control is required to be an element of a regular control constraint set $\Omega \subseteq R$ of the form

$$\Omega = \{u \in R^s \mid h(x,u) \geq 0\} \tag{3}$$

where $x = \xi(u)$ is the solution to (2) given u. The functions $G_i(x,u)$: $R^n \times R^s \to R^1$,

$g(x,u) : R^n \times R^s \to R^n$, and $h(x,u): R^n \times R^s \to R^q$ are assumed to be C^1, with

$$\left|\frac{\partial g(x,u)}{\partial x}\right| \neq 0, \tag{4}$$

in a ball about a solution point (x,u).

A coalition $T_1 = \{1,2,\ldots,m\} \subset \{1,2,\ldots,m, m+1,\ldots,r\}$ (the set of all players) is formed and another coalition $T_2 = \{m+1,\ldots,r\}$ is formed by the other players. Therefore pareto-optimal control of each coalition must be appearing, where cooperation among all of the players is possible in each coalition. It is assumed that each player in coalition T_1 helps the others up to the point of disadvantage to himself also each player in coalition T_2 helps the others up to the point of disadvantage to himself. Both two coalitions are playing according to Nash equilibrium solution concept, without collaboration with any of the other coalition.

Let $u = (u_1, u_2,\ldots, u_m) \in R^m$ be a composite control for coalition T_1 and $\upsilon = (u_{m+1}, u_{m+2}, \ldots, u_r) \in R^{s-m}$ denote the composite control for the other coalition T_2. The composite control $(u,\upsilon) \in R_s$.

Pareto- minimal solutions for coalition T_1 may be attained by seeking to:

$$\text{Min } G_{t1}(\eta, x, u, \upsilon) = \sum_{i=1}^{m} \eta_i G_i(x, , u, \upsilon)$$

Subject to the constraints

$g(x,u) = 0$,

$$\Omega = \{u \in R^s \mid h(x,u) \geq 0\}, \tag{5}$$

$\eta_i \geq 0, \sum_{i=1}^{m} \eta_i = 1, i=1$ tom

Also pareto-minimal solutions for coalition T_2 may be attained by seeking to:

$$\text{Min } G_{t2}(\eta, \xi(u, \upsilon), u, \upsilon) = \sum_{i=m+1}^{r} \eta_i\, G_i(\xi(u, \upsilon), u, \upsilon)$$

Subject to the constraints

$g(x,u) = 0$

$$\Omega = \{u \in R^s \mid h(x,u) \geq 0\} \tag{6}$$

$\eta_i \geq 0, \sum_{m+1}^{r} \eta i = 1$, i = m + 1, …, r.

Definition 1

A point $(u^*, \upsilon^*) \in \Omega$ is a pareto-minimal solution for any coalition (T_1 or T_2) if and only if there does not exist a $(u,\upsilon) \in \Omega$ such that

$G_i(\xi(u,\upsilon), u,\upsilon) \leq G_i(\xi(u^*,\upsilon^*), u^*,\upsilon^*)$,

for all $i \in \{1,\ldots, m\}$ for coalition T_1 or for all $i \in \{m+1,\ldots,r\}$ for coalition T_2 and

$G_j(\xi(u,\upsilon), u,\upsilon) < G_j(\xi(u^*,\upsilon^*), u^*,\upsilon^*)$,

for some $j \in \{1,\ldots,m\}$ for coalition T_1 or for some $j \in \{m+1,\ldots,m\}$ for coalition T_2 .

Theorem 1

If $(u^*, \upsilon^*) \in \Omega$ is a regular local pareto- minimal solution for any coalition T_l, l = 1or 2 and if $x^* = \xi(u^*, \upsilon^*)$ is the corresponding solution to $g(x, u^*,\upsilon^*)=0$, then there exist vectors $\eta \in R^r$, $\lambda \in R^n$, $\varphi \in R^q$ and $\varphi \geq 0$, such that

$$\frac{\partial L_l(x^*,u^*,\upsilon^*, \eta, \lambda, \varphi)}{\partial x} = 0$$

$$\frac{\partial L_l(x^*,u^*,\upsilon^*, \eta, \lambda, \varphi)}{\partial u} = 0$$

$$\frac{\partial L_l(x^*,u^*,\upsilon^*, \eta, \lambda, \varphi)}{\partial v} = 0$$

$g(x^*, u^*,\upsilon^*) = 0$

$\varphi\, h(x^*, u^*,\upsilon^*) = 0$

$h(x^*, u^*,\upsilon^*) \geq 0$

$\eta_i \geq 0, \sum_{i \in Tl} \eta_i = 1$, l = 1 or 2

Where,

$L_l(x, u, \upsilon, \eta, \lambda, \varphi) = \sum_{i \in Tl} \eta_i^T G_i(x, u, \upsilon) - \sum_{j=1}^{r} \lambda_i^T g_j(x, u, \upsilon) - \sum_{j=1}^{r} \varphi_k^T h_k(x, u, \upsilon)$.

Zeleny (8) has suggested that the set of efficient solutions can be reduced by introducing "the compromise set" concept.

To obtain the compromise solution for each coalition in problems (5) and (6), find the solution which has a minimum distance with respect to the solution G_l^L(ξ (u, υ), u, υ), i ∈T_l, l = 1,2. This idea requires normalization of the objective functions and appropriate choice for the distance measure. The solutions found in this way are a reduced set of all efficient solutions. The set of compromise solutions may be large, and also the choice of weights by players in each coalition may be difficult. These difficulties could be reduced by combining the basic ideas for the methods of compromise programming and compromise weights.

Compromise Weights for Coalition T_1ANDT$_2$

The interactive compromise Programming (ICP) method is based on two main ideas:

First, the players in coalition T_l, l= 1,2 could state his preference among some alternative solutions more easily if the values of cost functions were measured on the same scale varying between zero and one. This could be done by employing "the membership functions" for the cost functions concept in the compromise programming for each coalition. In this method, the following definition of the membership functions is used for scaling for problem (5) and (6) of coalition= T_1 and T_2:

μ_{Gi} (ξ (u, υ), u, υ) = $\frac{G_i(\xi(u,\upsilon),u,\upsilon)-G_i^L}{G_i^U-G_i^L}$, i ∈$T_l$, l = 1 for coalition T_1 and l = 2 for coalition T_2 (7)

where G_i (ξ (u, υ), u, υ) are the cost functions,

$G_i^U$are the maximum possible values of G_i (ξ (u, υ), u, υ), and $G_i^L$are the minimum possible values of G_i (ξ (u, υ), u, υ) satisfying the constraints Ω, i ∈T_l, l = 1,2.

The μ_{Gi}(ξ (u, υ), u, υ) are defined as the membership functions of G_i(ξ (u, υ), u, υ) to the minimum possible value G_i (ξ (u, υ), u, υ), i ∈T_l, l = 1,2.

The secularization problem for coalition T_1 is proposed as the following problem:

Min $\mu_{G^{m+1}}$ (ξ (u, υ), u, υ)=$\sum_{j=1}^{m} \eta_i \mu_{G_i}(\xi(u,\upsilon),u,\upsilon)$
S.T
g(x,u,υ) = 0
Ω = {u ∈ R^s | h (x, u, υ) ≥ 0} (8)

$\eta_i \geq 0$, $\sum_{i=1}^{m} \eta_i = 1$, i= 1, …, m.

Also the scalarization problem for coalition T_2 is:
Min $\mu_{G^{r+1}}$ (ξ (u, υ), u, υ) =$\sum_{i=m+1}^{r} \eta_i \mu_{G_i}(\xi(u,\upsilon),u,\upsilon)$

S.T
g(x,u,υ) = 0
Ω = {u ∈ R^s | h (x, u, υ) ≥ 0} (9)
$\eta_i \geq 0$,$\sum_{i=m+1}^{r} \eta_i = 1$, i= m+ 1, …, r.

The second main idea, one of the main drawbacks of the interactive methods is the difficulty of getting the weights of the cost function from the players even if the values of the cost functions are presented to him on the same scale. In this method, the compromise weights of the cost functions can be obtained by means of the pay-off matrix p of order mxm of coalition T_1 and r x r of coalition T_2 of which (m,r) successive columns show the effects of the i instrument vector (x_i^*, u_i^*, v_i^*) on the membership cost functions for coalition T_1 and T_2 respectively:

P_{t1} = ($\bar{\mu}_G(x_i^*, u_i^*, v_i^*)$,…………….., $\bar{\mu}_G(x_m^*, u_m^*, v_m^*)$)
P_{t2} = ($\bar{\mu}_G(x_{m+1}^*, u_{m+1}^*, v_{m+1}^*)$,……, $\bar{\mu}_G(x_r^*, u_r^*, v_r^*)$).

The compromise weights η_i, i ∈T_l, l = 1,2 (for each coalition) can be obtained from the normalized version of the pay-off matrix P as in the form:

$\eta_i = \frac{(P_{ti}^t)^{-1}\underline{L}^t}{\underline{L}(P_{ti}^t)^{-1}\underline{L}^t}$, i ∈$T_l$, l =1 for coalition T_1, and l =2 for coalition T_2, (10)

where $\underline{L}$ is the unit vector and $\underline{L}^t$ is the transpose unit vector. Also t Ptl is the transpose pay-off matrix p.

The process is terminated when one of the following occurs:

1. The players in coalitionT_l, l = 1,2 satisfied with the current solution.
2. The inverse of matrix p does not exist in this case the original set of normalized weights η_i, i = 1,…,m (for coalition T_1) is computed from another formula (4):

$\eta_i = \frac{e^{\alpha 1 ai}}{\sum_{i=1}^{m} e^{\alpha 1 ai}}$, i= 1…..., m, where
$\alpha_1 = \frac{1}{a_r - a_{r-1}} \; Ln\left|\frac{\sum_{i=1}^{m} a_i}{a_m}\right|$ (11)
$a_i = \hat{G}_i - G_i^*$, i∈ T_1, i= {1,..,m},
$\hat{G}_i$= Max G_i (ξ (u^i, υ^i), u^i, υ^i), G_i * = Min G_i (ξ ((u^i, υ^i), u^i, υ^i)),
also the original set of normalized weights η_i, i = m+1,…,r (for coalition T_2) computed from:
$\eta_i = \frac{e^{\alpha 1 ai}}{\sum_{i=1}^{m} e^{\alpha 1 ai}}$,i ∈ T_2,
where $\alpha_2 = \frac{1}{a_r - a_{r-1}} \; ln\left|\frac{\sum_{m+1}^{r} a_i}{a_m}\right|$ (12)
$a_i = \hat{G}_i - G_i^*$, i∈ T_2, i= {m+1,..,r},
$\hat{G}_i$ = Max G_i (ξ (u^i, υ^i), u^i, υ^i), G_i * = Min G_i (ξ ((u^i, υ^i), u^i, υ^i)),

Stability Set of the Firstkind

Definition 2

The solvability set of coalition T_1 for problem (5) is defined by:
B_{t1}= {η∈R^m | Min G_{t1} (η,ξ (u, υ) u, υ) exists},
also the solvability set of coalition T_2 for problem (6) is defined by:
B_{t2} = {η∈R^{s-m} | Min G_{t2} (η,ξ (u, υ) u, υ) exists}.

Definition 3

Suppose that B_{te} ≠φ for coalition T_l, (l = 1 or 2) with a corresponding pareto-minimal solution($\bar{x}$, $\bar{u}$, $\bar{\upsilon}$) then the stability set of the first kind of coalition T_l corresponding to ($\bar{x}$, $\bar{u}$, $\bar{\upsilon}$) is defined by $S_{tl}(\bar{x}, \bar{u}, \bar{\upsilon})$ = {η∈ B_{te} | $\sum_{i\in Tl}$ ηi Gi ($\bar{x}, \bar{u}, \bar{\upsilon}$) = Min $\sum_{i\in Tl}$ ηi Gi ($\bar{x}, \bar{u}, \bar{\upsilon}$), l=1 for coalition T_1 and l = 2 for coalition T_2}.

It is clear that the stability set of the first kind is the set of all parameters corresponding to pareto-minimal solution of the scalarization problem (5) for coalition T_1 or problem (6) for coalition T_2.

To determination the stability set of the first kind S_{t1} (x*, u*, υ*) for coalition T_1 or the stability set of the first kind S_{t1}(x*,u*, υ*) for coalition T_2 substituting in the system of equations given by theorem (1)we obtain the set

$D_{tl} = \{(\eta,\lambda,\varphi) / \sum_{i\in Tl}\eta_i \frac{\partial G_i(x^*,u^*,v^*)}{\partial x} - \sum_{j=1}^{n}\lambda_j \frac{\partial g_j(x^*,u^*,v^*)}{\partial x} - \sum_{k=1}^{q}\varphi_k \frac{\partial h_k(x^*,u^*,v^*)}{\partial x} = 0,$

$\sum_{i\in Tl}\eta_i \frac{\partial G_i(x^*,u^*,v^*)}{\partial u} - \sum_{j=1}^{n}\lambda_j \frac{\partial g_j(x^*,u^*,v^*)}{\partial u} - \sum_{k=1}^{q}\varphi_k \frac{\partial h_k(x^*,u^*,v^*)}{\partial u} = 0,$

$\sum_{i\in Tl}\eta_i \frac{\partial G_i(x^*,u^*,v^*)}{\partial v} - \sum_{j=1}^{n}\lambda_j \frac{\partial g_j(x^*,u^*,v^*)}{\partial v} - \sum_{k=1}^{q}\varphi_k \frac{\partial h_k(x^*,u^*,v^*)}{\partial v} = 0$

l =1for coalition $T_1$and l =2 forcoalitionT_2}. (13)

For coalition T_1 this system represents n + r linear equations in m + n + q unknowns η_i, i= 1,..,m, λ_j, j=1,…,n, and φ_k, k = 1,…, q which can be solved and for coalition T_2 this system represents n + r linear equations in (s-m+n+q) unknowns η_i, i= m+1,..,r, λj, j=1,…,n, and φk, k = 1,…, q Which can be solved.

The stability set of the first kind for coalition T_1 and for coalition T_2 is

$S_{t1}(x^*,u^*,\upsilon^*)=\{\eta\in R^m|(\eta,\lambda,\varphi)\in D_{t1}\}$ (14)

S_{t2} (x*, u*, υ*=$\{\eta \in R^{s-m} \mid (\eta, \lambda, \varphi) \in D_{t2}\}$, respectively. (15)

Nash Cooperative Solution Forcoalition T_1 and Coalition T_2

After obtaining the compromise weights η_i^*, i= 1,…,m which obtain the best compromise solution for coalition T_1 and η_i^*, i=m+1,…,r which obtain the best compromise solution for coalition T_2, the two coalition are playing according to the Nash equilibrium solutions concept by solving :

Min G_{tl} (x,u,υ) =$\sum_{i\in Tl}\eta_i^*$ G_i(x, u, υ), l = 1, 2
S.Tg(x,u,υ) = 0 (16)

$\Omega = \{u \in R^s \mid h(x, u, \upsilon) \geq 0\}$

Definition 4

A point $\hat{u}\in\Omega$ is a Nash cooperative point for problems (16) if and only if,

$G_{t1}(\xi(\hat{u}),\hat{u}) \leq G_{t1}(\xi(u,\hat{\upsilon}), u,\hat{\upsilon})$ for coalition T_1, and
$G_{t2}(\xi(\hat{u}),\hat{u}) \leq G_{t2}(\xi(u,\hat{\upsilon}), u,\hat{\upsilon})$for coalition T_2, where $\hat{u} = (\hat{u},\hat{\upsilon})\in\Omega$

Theorem 2

If $\hat{u}\in\Omega$ is a completely regular local Nash cooperative solution for the game (16) and $\hat{x} = \xi(\hat{u})$ is the solution to g(x, $\hat{u}$) = 0, then for each coalition T_1 and T_2 there exists a vector $\lambda(t_l)\in R^n$ and a vector

$\mu(t_l) \in R^q$, l = 1, 2 such that

$\frac{\partial Lt_l(\hat{x},\ \hat{u},\ \lambda(t_l),\mu(t_l))}{\partial x} = 0$, l = 1, 2

$\frac{\partial Lt_1(\hat{x},\ \hat{u},\ \lambda(t_1),\mu(t_1))}{\partial u} = 0,$

$\frac{\partial Lt_2(\hat{x},\ \hat{u},\ \lambda(t_2),\mu(t_2))}{\partial v} = 0,$

$g(\hat{x},\ \hat{u}) = 0$

$\mu^T(t_l)\, h(\hat{x},\ \hat{u}) = 0$

$\mu(t_l) \geq 0$

where L_{tl} (x,u, λ (t_l) μ (t_l)) = G_{tl} (x,u,) - $\lambda^T(t_l)$ g(x,u) - $\mu^T(t_l)$ h(x,u), l = 1, 2.

The Algorithm of Interactive Stability Compromise Programming for Solving Nash Cooperative Continuous Static Games

The steps of the algorithm can be summarized as follows:
Step 1: A coalition T_1 = { 1,…,m} ⊂ {1,2,…,r} (the set of all players) is formed and another coalition T_2 = { m+1,…,r} is formed by the other players where cooperation among all of the players is possible in each coalition.
Step 2: Construct problem (5) and (6) for coalitions T_1 and T_2.
Step 3: An interactive stability compromise method is used for solving (NCCSG) problems as follows:

for coalition T_l, set l = 1,Determine G_i^U, $G_i^L$for all i ∈ T_l as follows:

(i) Max G_i (ξ(u,υ), u, υ), i ∈ T_l S.T g(x,u,υ) = 0 Ω = { u ∈ R^s | h (x, u, υ) ≥ 0}

The solutions of this problem u^{iU},v^{iU} are and G_i^U.

(ii) Min G_i (ξ(u,υ), u, υ), i ∈ T_l
S.T g(x,u,υ) = 0 Ω = { u ∈ R^s | h (x, u, υ) ≥ 0}

The solutions of this problem $u^{iL,}$$v^{iL}$ are and G_i^L

Step 4: Determine the membership functions corresponding the solution (u^{iL},υ^{iL}), i ∈ T_l as in relation (7). The pay off table can be arranged for coalition T_l (for coalition T_1 using Table (1) and for coalition T_2 using Table (2)) as follows:-

Table 1 Pay-off table for coalition T_1

μ	(u^1,v^1)	(u^2,v^2)	….	(u^m,v^m)	G_i^L
G_1	$\mu_{G_1}^1$	$\mu_{G_1}^2$	….	$\mu_{G_1}^m$	G_1^L
G_2	$\mu_{G_2}^1$	$\mu_{G_2}^2$	….	$\mu_{G_2}^m$	G_2^L
G_3	$\mu_{G_3}^1$	$\mu_{G_3}^2$	….	$\mu_{G_3}^m$	G_3^L
.	…….	……..	….	…….	…….
.	…….	…….	….	…….	…….
G_m	$\mu_{G_m}^1$	$\mu_{G_m}^2$	….	$\mu_{G_m}^m$	G_m^L

Table 2 Pay-off table for coalition T_2

μ	(u^{m+1},v^{m+1})	(u^{m+2},v^{m+2})	….	(u^r,v^r)	G_i^L
G_{m+1}	$\mu_{G_{m+1}}^1$	$\mu_{G_{m+1}}^2$	….	$\mu_{G_{m+1}}^m$	G_{m+1}^L
G_{m+2}	$\mu_{G_{m+2}}^1$	$\mu_{G_{m+2}}^2$	….	$\mu_{G_{m+2}}^m$	G_{m+2}^L
.	……	……..	….	…….	…….
.	…….	…….	….	…….	…….
G_r	$\mu_{G_r}^1$	$\mu_{G_r}^2$	….	$\mu_{G_r}^m$	G_r^L

where $\mu_{G_i^s}$ the value of in u^s , υ^s , i ∈ T_l .

Step 5: The compromise weights η_i, i ∈ T_l can be found from the relation (10). If $(P_{ti}^t)^{-1}$doesnot exist, the set of normalized weights ηi, i ∈ T_l is computed from (11) if l = 1 or from (12) if l = 2.

Step 6: By using these weights, we establish the new composite function to obtain the new alternative compromise solution, (u^{m+1}, υ^{m+1}) for coalition T_1 from problem (8), (u^{r+1}, υ^{r+1}) for coalition T_2 from problem (9).

Step 7: Determine the stability set of the first kind corresponding to this solution as in relations (13) and (14) for coalition T_1 and in relations (13) and (15) for coalition T_2.
Step 8: Determine the membership cost functions of the new solution of problem in step 6, ${}^{\mu}{}_{G}{}^{m+1}$ for coalitions T_1 or ${}^{\mu}{}_{G}{}^{r+1}$for coalitions T_2. Add this column to the table in step 4.

Step 9: Ask the players in coalition T_l whether he prefers one solution strictly over all the other m- solutions for coalition T_1 or r- solutions for coalition T_2. If he does, go to step 11. Otherwise ask him his least preferred solution among all the others. Then replace this preferred solution by the new found in step 8 and go to step 5.

Step 10: set l =2 and repeat the steps from step 3 to step 9, and go to step11.

Step 11: After obtaining the compromise weights for each coalition which obtain the best compromise solution for coalitions T_1 and T_2, the two coalitions are playing according to the Nash equilibrium solutions concept by solving problems (16). The solution is called Nash cooperative solution.

Step 12: Stop.

CONCLUSION

This paper, proposed a method called interactive stability compromise programming decision making for solving Nash cooperative continuous static games by using the method of compromise programming and the method of compromise weights from the pay-off table of membership function for each cost function in each coalition. Also we obtain the stability set of the first kind for the solution in each coalition.

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