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Research paper

The Solving of Linear Programmable Problems Using Hybrid Algorithms

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Abstract

This paper presents the pointing and investigation of an effectiveness relating a linear mathematical formulation to solve an linear programmable problems based on hybrid algorithms. The hybrid is packages of mathematical programs which contain much occupation required for solve many criteria of linear program (LP) problems. Additionally, a single criterion with linear quadratic problems is solved in this work. For dynamic problems, the hybrid algorithms are useful because the practical algorithm develop the configuration of dynamic problems. The advantage of handling dynamic problems to the user is to produce a simple method of criterion formulation model. The orientation of hybrid is interactive form of process whose a series of problems are answered based changeable situation such as dissimilar objectives functions. The multi objectives criteria could be simply defined and efficient to assist the package. Additionally, the hybrid present more options to diagnostic and verify the problem solving. The suggested approach is hybrid algorithms to solve absolute value equation with no supposition and solvability in linear systems equations followed by linear programs iteratively. The proposed algorithms has been tested and investigated properly**.**

Keywords: Hybrid Algorithms, Linear Programming, Absolute Value

1. Introduction

Nowadays the multi objectives problems need to provide enough considerate of the hybrid package as well as practical and theoretical foundation. The user guide of hybrid [1] is containing the following topics:

1. The methods of selecting a different options presented by the package.
2. The formulation guidelines and problems modification to be solved by hybrid processing.
3. The procedure of which the hybrid offers the diagnostics and results calculations.
4. Many tutorial examples in the same field
5. The MPS standards specifications for input information

In the hybrid 3.1 version many options which can be used to solve the static and dynamic LP as well as the problems through extra arrangement than the traditional one. Additionally, hybrid version 3.1 could subsist for the solitary and different criteria LP also. In the same time, this version could be use for solitary criterion [2,3]. In the view of the fact that mix form is plan for actual time problems because it offer a lot of function which be useful to diagnostic problems in hand [3]. While this design supports usage of multi criteria point optimization, the hybrid becomes a associate of DIDAS group decision investigation [4]. In any analysis team composed of decision maker, the hybrid might be used as instrument to decide a choice in a difficult case due to contain the hybrid techniques of many options which could be examined and investigated. Many problems of economic planning and technology designing could be controlled using the hybrid algorithms. In order to explain the possible applications which is used in the suggested approach has been followed and applied to solve many problems.

The most applications in this field using hybrid algorithms are illustrated in the policy of agriculture planning economy [5,6]. The control of flood configuration and utilization of water source in the country side area is planning and solved [7,8]. The deceptive termination avoidance in case of using hybrid algorithms may be represented by replacing a truth decision maker and stress the hybrid plan to assist this decision and concentrate the actual duty. To solve any linear programs problem, the hybrid algorithms could be used and help the researcher easily such as the applications of operational research policy. The transportation, economic and production development optimization problems could be formulated as a linear dynamic problems approach [9,10]. One could formulate the dynamic problems as equivalent LP and corresponding code to solve them where the problems communicate to solitary objectives optimization which is more useful and offer the more facilities [8]. In the case of multi criteria problems one could be used the processor to transfer the problems LP equivalent programs [11]. The first version of DIDAS systems is by composed the package processor and post processor to grip and transformative the multi criteria problem and process the results [12,13]. In individual of preprocessor and postprocessor which connected with the package of LP situation, the hybrid of version 3.1 has same design. The hybrid methods contain same benefit to handle the problems as dynamic which results in simple methods to prepare the criterion. This will be happen due to only single changeable route different to stationary format of active problems who engross split variable in every period of time [14,15]. The hybrid structure has been planning for real

problems that necessitate analysis situation for academic arbitrary created problems and in hand study. Consequently, the hybrid technique is sloping toward the inter-active form of process that's the series of many problems under hand with unreliable situation such as many different objectives [16].

1.1. Program Explanation

To prepare the formulation of problem, first one could define the problem that answer as arithmetical program module then design the algorithms which is suitable to get fin results. A complex task is to formulate the mathematical programs model and the design of hybrid algorithms is a more difficult duty [17]. Therefore, a recommended approach is introduced in this paper. Hence, a group of variables that adequately described the problem for explain analysis should be chosen firstly. The group of concentrate that define a group of allowable explanation should be define afterword. Lastly, a group of criteria should be selected and distinct to serve the solution [18].

1.2. Model Configuration

The conformation design [19] is critical for real purpose of any mathematical programs in advance. The first step of an MPS file procedure using hybrid algorithms to propose a lot of helpful alternative to the suggested duty is pointed. The second step contains the solving optimization problems for chosen criteria to help in investigation solution of reliability. Following the analysis of solution, one could change each parameters showing below:

1. The coefficients values
2. The constraints values
3. Any other parameters necessary in the problem solving

The changing of any above parameters might completed by interactive assistance methods rather than file in the form of MPS which be used in communicated area that contain formulation of problem processed by hybrid algorithms. Hence, one could needs no longer original MPS which have only the endorsement functions [20].

1.3. The Analysis of Multi Objectives Problems

The user could define different multi objective problems for given model to be analyzed which contains the following steps:

1. The obtained solution analysis
2. Modified problem solution
3. Problem modification

The analysis of obtained solution contains the following optional steps:

1. The value of selected criteria should be examined properly to obtain results in optimal hybrid mode and the compensation by each idea with no deterioration some other idea. The value of every idea should be compared reciprocally and important computing the best solution for any criteria individually.
2. Keeping in mind the alterations to the creative problems without concerning the file in the MPS form.
3. The hybrid algorithms permit for simple test of trajectory for active problems.

The modified problem solution could be implementing in two methods as follow:

1. In this step, one could modify the formulation of original model with major expected activity after the design is defined as well and verified. Additionally, no need to change any parameters that define the accepted group. Each change of these parameters group is typically produced in change in optimal solution.
2. In case of constraints values and coefficients are acceptable, one could start to compute the point and this will do in interactive methods.

The user might choose any four types of criteria equivalent to realistic applications which could be defined for each time. Hence, in case of problems has dynamic situations, the idea are particularly solved by criterion only and the name of generic equivalent variable could be used. The model could be stated as a dynamic via description intervals. In this case, additional rules should observe as well corresponding to the procedure in which the MPS file has been stored..

2. Data structure and software package

In proposed model, the package has been constructed in module to achieve reasonability and high rank of flexibility with enough efficiency in the suggested design. These fundamental is for normal utilize of the resource of pc and possible modification in the hybrid algorithms with package extensions. The package contains five sub-packages which explain as follow:

- The information will processing and enable the modified of design, two preprocessor were need. One is used for dispensation of primary mode and transforms multi criteria problems to the parametric single criteria optimizations.
- To perform investigation of answer and any change of every factor, the second preprocessor will insert in the model.
- The so called (package optimization) of relevant optimization for static and dynamic problems.
- To provide the results in MPS formal standard and produce the file used whose contain all desired data for investigation, a postprocessor were need in the design.
- To simplify the usage of all sub-packages, the driver is accomplishing to model design. The version of computer is driver provide a context assist in professional tradition package under hand.

The above sub-packages are use a binary file which contain all information about the problems under solving conditions. The 2nd binary file consist the answer got by final sprint of the solve algorithms. The selection procedure of allocation storage in the memory offers many advantages for existing pc memory and the problem property for actual planet. The concentrates matrix is large enough even as the number of coefficients with none zero is greatly lesser than the number of all coefficients non zero in the model. In the solved problem, the super spares matrix method is applied to accumulate the data which occupy the constructions of coefficients table in dissimilar values. Hence, management of memory has been treatment using flexible methods. Such advance gave quicker implementation to reduce the necessities of memory. To support the design verification and problem modifications, special commands of hybrid algorithms should be used. The important of this analysis scenario is to decrease the problems comes due to inappropriate

scaling. Data formatting of MPS file input and LP results output follows the adopted mathematical program system.

3. Solution technique

The improved high gain implementation using hybrid algorithms for solving linear program problems is the best techniques nowadays with some constraints. By minimize a sequence of quadratic function, the LP problem is solved. To provide this minimization, a combined of the conjugate gradient methods with dynamic constraints plan. Many techniques oriented for solving dynamic linear problems has developed in recent years. The majority of these techniques contain an adaptation of simplex procedure with unusual design of constraints. The first consideration of linear programming problem (P) is:

$$\min\ dy \tag{1}$$

$$d - s \le By \le c \tag{2}$$

$$m \le y \le v \tag{3}$$

Where $y, f, m, v \in S^n, c, s \in S^m$ *and* B *is an* $m \times o$ *matrix*

Two groups of constraints were found, one is called general constraint (2) and the second one is called simple constraint (3). The MPS file input vector (b) is called RHS and the vector (s) is called RANGE file. Additionally, the vector (m) and (v) are named lower and upper limits correspondingly. As shown, some limits and range might has value of infinite and the hybrid could be used to solve this LP problem and formulated by accepted methods based commercial package in this case. Regard as a traditional formulation of LP dynamic problem in the shape as follow:
To find the trajectory control of the formula $v = (v_1, \dots\dots, v_T)$ and static trajectory of the formula $y = (y_{1,} \dots\dots, y_T)$ to satisfy the equation below with condition y_0

$$y_t = B_{t-1}y_{t-1} + C_t v_t - D_t \tag{4}$$

Consider the constraints is

$$e_{t-1} - s_{t-1} \le G_{t-1}\, y_{t-1}\ E_t\, v_t \le e_{t-1} \qquad t = 1, \dots\dots\dots, T \tag{5}$$

$$f_t \le v_t \le g_t \qquad t = 1, \dots., T \tag{6}$$

$$G_T x_T \le e_T \tag{7}$$

Which decrease the presentation directory?

$$\sum_{t=1}^{T}(b_t y_T + c_t v_t) \tag{8}$$

Where

- The time interval (t =1,……., T)
- y_T , v_T, variable and control variable respectively, for every period
- matrices B,C,D,F, assume this is known
- The RSH vectors d_t and e_t with range vector s_t
- Bound control variable f_t and g_t are known
- Given x_o as initial condition

The formulation shown above has been selected to simplify the problem and the below modification is established.

a. Equality constraints could be used instead of inequality
b. The constraints of bound is permitted for variable y as individual in columns of MPS file, hence properly hold as dissimilarity restriction of type
c. The presentation index could be moreover specific as single objectives or changed by dummy objective meaning defined by alteration of multi criteria parametric LP problem

The CDLP problem organization shown in table 1 will consider as example to proof the proposed idea where 1, 0 identify matrix and matrix composed of zero respectively..

Table 1: CDLP problem structure

v_1	v_2	v_3	y_0	y_1	y_2	y_3	rsh	$var.$
C_1	0	0	B_0	-J	0	0	d_1	Equation situation.
0	C_2	0	0	B_1	-J	0	d_2	Equation situation
0	0	C_3	0	0	B_2	-J	d_3	Equation situation
E_1	0	0	G_0	0	0	0	e_0	restriction
0	E_2	0	0	G_1	0	0	e_1	restriction
0	0	E_3	0	0	G_2	0	e_2	restriction
0	0	0	0	0	0	G_3	e_3	last situation
c_1	c_2	c_3	0	b_1	b_2	b_3	-	objective

4. Dynamic linear problem formulation

The CDLP formulation has been selected for simplification of arrangement purpose. Hence, the hybrid version 3.1 is talented to resolve a dynamic linear programming problem (DLP) as in following steps. Firstly, let as consider the following name of matrices which no require being block diagonal matrix and not have any specific design:

- $C = diag(C_i)$
- $E = diag(E_i)$
- $G = diag(G_i)$

Hence, the exact example of DLP is a CDLP problem and the major practical simplifications in this case represented by delay to control the variable and solved using hybrid algorithms. In reality, the hybrid accept the problem with delay either for state and control variable to achieve the state variable for period before initial state without state equation. The criteria selection of CDLP problem is limited compared with DLP problems. The variables could be separated into 2 collection named decision variables (v) and condition variable (y_t). The DLP criteria problem could be formulated by the followed question:
Find the decision variable (v) and trajectory(y_t) which satisfy the following equation?

$$-\mathrm{I_t}\, y_t + \sum_{i=0}^{t-1} \mathrm{A_{t-1}iy_i} + \mathrm{C_t} v = d_t \quad t = 1, \dots\dots\dots, T \tag{9}$$

With given constraints and initial conditions y_0 as shown bellow, the following function limitation will satisfy as well.

$$\mathrm{e} - \mathrm{s} \le \sum_{t=0}^{T} \mathrm{G_t}\, y_t + Ev \le e \tag{10}$$

$$f \le v \le g \tag{11}$$

$$\sum_{t=1}^{T} \mathrm{b_t}\, y_t + cv \tag{12}$$

The components of vector (v) could be named a decision variable which will composed of any variable for each time period. Thus, some v vectors components might not specified for any time period as in dummy variable. One could be used the symbols in the requirement file to define the DLP problems. The first symbol represent the number of periods depends of above formulation (NT) and the second symbol represent the number of state variables in every interval which stand for the y_t vector dimension (NSTV). By using hybrid algorithms, the slack variables could be generated as well. So, to simplify the presentation, the state equation will consider only. Then, the design of DLP problem could be arranged as in table 2. Where (I_t) sloping matrix and 0 is is a matrix collected of zero essentials.

Table 2: DLP problem structure

v	x_0	x_1	x_2	x_3	rsh	$var.$
C_1	B_{00}	$-I_1$	0	0	e_1	$State\ Eq.$
C_2	B_{10}	B_{11}	$-I_2$	0	e_2	$State\ Eq.$
C_3	B_{20}	B_{21}	B_{22}	$-I_3$	e_3	$State\ Eq.$
E	G_0	G_1	G_2	G_3	e	$Constr.$
c	0	b_1	b_2	b_3	-	$Goal$

4.1. The Optimization of Multi Criteria Problems

The model user identifies a criteria numbers as objectives of decision maker. In the case of static linear programming problem, the criteria are a mixture of linear variables while in the case of DLP one could use other types of criteria. The multi criteria problems could be distorted interested in secondary parametric LP problems but a specific ambition level is not possible. After that, the optimal point is the adjacent to the ambition level in the casing of chebyshev weighted form. In the casing of DM explores various, the optimal points could be change by the aspiration level or weights close to criteria. The methods illustrated above could be repeated until acceptable solution is achieved.

5. Conclusion

In this paper, the development and comprehensive the package for dynamic linear programming model (DLP) is presented. Additionally, the static and dynamic problems for multi criteria has been investigated and improved. Further and next generation of hybrid algorithms could be more tuning to produce best solution in easy way. More testing for suggested hybrid will achieved from other researcher in soon future. The proposed idea is still need to offer more solution requirements for scenario analysis in the solving problems with multi criteria problems and matrix elements. Additionally, the presentation is look like better than before due to that the MPS file is procedure only one time in the 1st sprint. In consecutive runs, the renew is affected coefficients has been done only. The very useful diagnostic for any LP model could be provided by hybrid algorithms with model verifications side. For standalone package, the hybrid could be used also and after possible modifications of problems in interactive methods might gave MPS format to use by other package problems. The user could communicate with packages to provide more modifications methods and develop ability of computers in simple procedure. Faster execution could be achieved by further improvements of algorithms and computer code.

Therefore, the analysis appears that an tradeoff between the possibility of recognize and optimal income in this work and the improvements software is able to compute the best income for a given recognize coefficients possibility. The suggested works implies the connection functions establish in linear programming model in constraints and objectives which provide same level of satisfactions in the results achieved. The achievement of optimization problems depend on modeling the objective function concerned and variables modeling.

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