



An approximate approach for fractional programming with absolute-value functions

Ching-Ter Chang

Department of Information Management, National Changhua University of Education, Paila Village, Changhua 50058, Taiwan, ROC

Abstract

This paper considers the following fractional programming with absolute-value functions:

(FP-A):

$$\min \quad Z = \frac{\alpha + \sum_{j=1}^n c_j |x_j|}{\beta + \sum_{j=1}^n d_j |x_j|} = \frac{N(x)}{D(x)}$$

subject to $Ax = b,$

where $x^T \in R^n$ is unrestricted; $b^T \in R^m$; α and β are the scalars; A is an $m \times n$ matrix; c_j s and d_j s are unconstrained in sign. In some cases when some of c_j s are positive and others are negative, adjacent extreme point (simplex-type) methods [Oper. Res. 19/1 (1971) 120; Eur. J. Oper. Res. 141 (2002) 233; Oper. Res. 13/6 (1965) 1029; Fractional Programming, Heldermann Verlag, Berlin, 1988] cannot be used to solve the problem (FP-A). In view of this, this paper proposes an approximate approach to reaching as close as possible an optimal solution of the problem (FP-A). First, the problem (FP-A) is converted into an equivalent non-linear quadratic mixed integer programming with absolute value. Then the model is linearized using piecewise logarithmic program with some linearization techniques. The whole problem is then solvable using the branch and bound method. The numerical example demonstrates that the proposed model can easily be applied to problem (FP-A).

© 2003 Elsevier Inc. All rights reserved.

E-mail address: chingter@cc.ncue.edu.tw (C.-T. Chang).

Keywords: Fractional programming; Linearization; Goal programming; Absolute value

1. Introduction

Li [9] first proposed a global approach to solving pure quadratic 0–1 fractional programming problems. Wu [10] further improved the linearization approach of Li. Later, Chang [6] derived a more general method for polynomial mixed 0–1 fractional programming problems. Anzai [8] and Stancu-Minasian [11] have developed some methods for integer fractional programming problems. Chang [7] provided an approximate approach for solving polynomial fractional programming problems. Shanno and Weil [1] proposed the simplex method for solving a programming problem with absolute-value as follows:

$$\begin{array}{ll} \min & Z = \sum c_j |x_j| \\ \text{subject to} & Ax = b, \end{array} \quad (1)$$

where x is unrestricted; c_j s are non-negative; A is an $m \times n$ matrix; b is an m -component column vector.

Recently, Chadha [2] indicated that in some cases (e.g., $N(x) \geq 0$, $D(x) > 0$, $c_j > 0$ and $d_j > 0$) the simplex-type algorithms [3,4] can be used to solve a fractional programming problem with absolute-value as follows:

(FP-A)

$$\begin{array}{ll} \min & Z = \frac{\alpha + \sum_{j=1}^n c_j |x_j|}{\beta + \sum_{j=1}^n d_j |x_j|} \\ \text{subject to} & Ax = b, \end{array} \quad (2)$$

where α and β are the scalars, other variables are as defined in (1).

However, in some cases, when some of c_j s are positive and others are negative, the simplex-type algorithms cannot be used to solve the problem (FP-A) because the problem is degenerate (for more details, see [2]).

To the best of our knowledge, no work has yet been done for obtaining a globally optimal solution for the problem (FP-A) because the problem is an unrestricted highly non-linear fractional programming problem with absolute value. This paper proposes a method using linearization, goal programming, and piecewise techniques to obtain the approximate globally optimal solution of the problem.

Download English Version:

<https://daneshyari.com/en/article/9507110>

Download Persian Version:

<https://daneshyari.com/article/9507110>

[Daneshyari.com](https://daneshyari.com)