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SINGULAR PERTURBATION OF SYMBOLIC FLOWS AND POLES OF THE ZETA FUNCTIONS. ADDENDUM

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1. Introduction

In the previous paper [3] we considered singular perturbations of symbolic flows and showed the existence of poles of the zeta functions associated with perturbed symbolic flows. The purpose of the present paper is to remove some conditions required in the previous paper.

Our aim in studying poles of the zeta functions is to show the validity of the modified Lax-Phillips conjecture for obstacles consisting of several small balls. The modified Lax-Phillips conjecture is concerned with the distribution of poles of scattering matrices. About this conjecture, see Lax-Phillips [8, Epilogue] and Ikawa [5]. When we want to apply Theorem 1 of the previous paper to this conjecture, we have to require some additional conditions on the configuration of the centers of balls, that is, the conditions (A.2) and (A.3) of [3, Section 4]. As a consequence of the improvement of the theorem, we can show the validity of the modified Lax-Phillips conjecture for all obstacles consisting of small balls whose centers satisfy only (A.1) of [3].

Now we shall introduce notations for the statement of our main theorem. Let L be an integer≥ 2, and let $A=[A(i,j)]_{i,j=1,2,\cdots,L}$ and $B=[B(i,j)]_{i,j=1,2,\cdots,L}$ be zero-one $L\times L$ matrices.

For $i,j\in\{1,2,\cdots,L\}$, we denote $i \underset{B}{\to} j$ when there is a sequence $i_1, i_2, \cdots, i_p$ such that $B(i_1, i)=1$, $B(i_{q+1}, i_q)=1$ for $q=1,2,\cdots,p-1$ and $B(j, i_p)=1$.

We assume on B the following:

There is $1<K\leq L$ such that

$$B(i,j)=0 \qquad \text{for all } j \quad \text{if } i\geq K+1\,, \tag{1.1}$$

$$i \underset{B}{\to} i \qquad \text{for all} \quad 1\leq i\leq K\,, \tag{1.2}$$

$$i \underset{B}{\to} j \text{ implies } j \underset{B}{\to} i \qquad \text{if} \quad i,j\leq K\,. \tag{1.3}$$

We assume also the following relation between A and B:

$$B(i,j)=1 \text{ implies } A(i,j)=1\,. \tag{1.2}$$