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## Submodule approach to creative telescoping by Mark van Hoeij

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**Abstract.** This talk proposes ideas to speed up the process of creative telescoping, particularly when the telescoper is reducible. One can interpret telescoping as computing an annihilator  $L$  in  $D$  for an element  $H$  in a  $D$ -module  $M$ . The main idea is to look for submodules of  $M$ . For a non-trivial submodule  $N$ , constructing the minimal operator  $R$  of the image of  $H$  in  $M/N$  gives a right-factor of  $L$  in  $D$ . Then  $L = L'R$  where  $L'$  is the telescoper of  $R(H)$ . To expedite computing  $L'$ , compute the action of  $D$  on a natural basis of  $N$ , then obtain the telescoper  $L'$  for  $R(H)$  with a cyclic vector computation. The next main idea is that when  $N$  has automorphisms, use them to construct submodules. An automorphism with distinct eigenvalues can be used to decompose  $N$  as a direct sum of submodules  $N_1, \dots, N_k$ . Then  $L' = \text{LCLM}(L_1, \dots, L_k)$  where  $L_i$  is the telescoper of the projection of  $R(H)$  on  $N_i$ . An LCLM can greatly increase the degrees of the coefficients, so  $L'$  and hence  $L$  can be much larger than the factors  $L_1, \dots, L_k$  and  $R$ . Examples show that computing each factor  $L_i$  and  $R$  separately can save a lot of CPU time compared to computing the full telescoper  $L$  all at once with standard creative telescoping.