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Localization of spatial solitons in arrays of nonlinear waveguides

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The propagation of spatial solitons in arrays of nonlinear waveguides may be controlled by variation of the coupling constants across the array. This results in a steering of the self-focused beam in the low-power regime. The effect of the inhomogeneity on the motion of spatial solitons can be well described by a potential similarity to classical mechanics. At high guided power, on the other hand, the beam is influenced by the discreteness of the array. In this regime spatial solitons tend to remain localized in the initial guide. In the present work, we describe the propagation of spatial solitons by a coupled mode theory. Additionally, we use a variational approach to derive analytical expressions which gives deeper insight into the underlying physics. The counteraction of beam deflection due to the inhomogeneity of the array and power-dependent localization offers the possibility to create, for instance, a nonlinear beam steering device which connects the input channel to different output guides depending on the injected power. We model this device both numerically and by our analytical approach.