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So

$$\left| \sum_{j=n}^{n+p} a_j b_j \right|$$

$$= \left| A_{n+p} b_{n+p} - A_{n-1} b_n + \sum_{j=n}^{n+p-1} A_j (b_j - b_{j+1}) \right|$$

$$\leq |A_{n+p}| b_{n+p} + |A_{n-1}| b_n + \sum_{j=n}^{n+p-1} |A_j| |b_j - b_{j+1}|$$